OPTIC ELECTRONIC

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opto-electronic sensors

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Whenever problems in automation technology have to be solved economically and efficiently with opto-electronic sensors, SICK will be your partner.

Contents

Selection criteria

The vast number of day-to-day production problems is matched by the plethora of devices available to solve them. This Photoelectric Switch Catalogue has been designed to help customers in choosing the appropriate device. But firstly a few words to explain the use and operation of the devices.

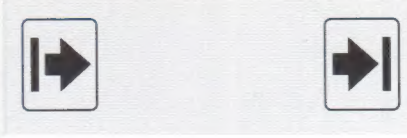
A main criterion in the selection process is the **Scanning Range (Photoelectric Switches)** and **the Scanning Distance (Photoelectric Proximity Switches).** This is clearly indicated both in the introductory pages and on the data sheets. Depending on the specification, it is the operating range and/or the limit scanning range. With regard to the limit scanning range, it should be borne in mind that, in a dusty atmosphere for example, this distance may be reduced by dirt on the optics. In such cases, a device for a correspondingly greater distance should be chosen.

The operating voltages are indicated in the Technical Data, in some cases as (absolute) limit values, in other cases with permitted tolerances.

The values given (e. g. lifetime of the LEDs) relate to an ambient temperature of +25 °C.

The devices are grouped into categories: through-beam photoelectric switches; photoelectric reflex switches; photoelectric fiber-optic switches; photoelectric proximity switches; luminescence scanners.

Through-beam Photoelectric Switch



The through-beam photoelectric switch consists of two devices: a light sender (e.g. WS 27) and light receiver (e.g. WE 27). The separate construction permits large scanning distances with a corresponding reserve capacity. It is ideal for use in unfavourable environmental conditions, e.g. wet, dusty, etc. Blanking enables relatively high switching accuracy to be achieved with low tolerances in relation to the repetition accuracy. Such an arrangement is also largely free from disturbance when there are reflecting objects in the light beam. Because there are two devices, they are accordingly more expensive to fit.

See Fig. 1

Photoelectric Reflex Switch

With photoelectric reflex switches (e.g. WL 27), the emitted light is returned by a reflector at a distance not exceeding the scanning distance and is evaluated by the device. This system involves less expensive fitting, since installation and wiring are only needed on one side. Polarizing filters prevent maloperation when reflecting objects are picked up, but one must ensure that the reflectors quoted are used.

See Fig. 2

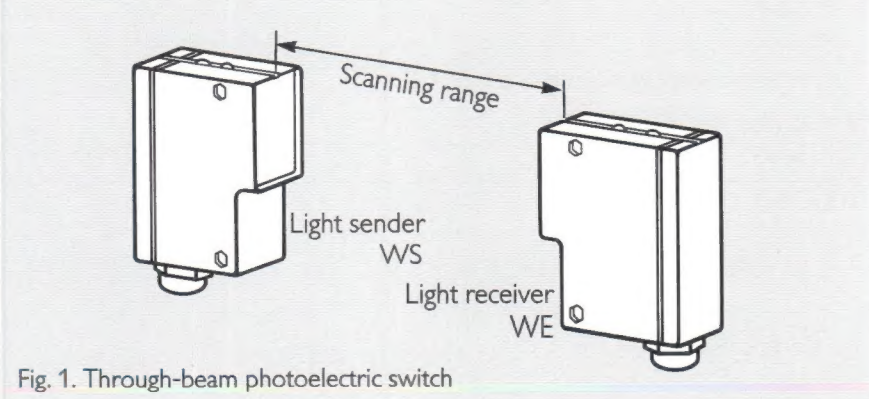


Fig. 1. Through-beam photoelectric switch

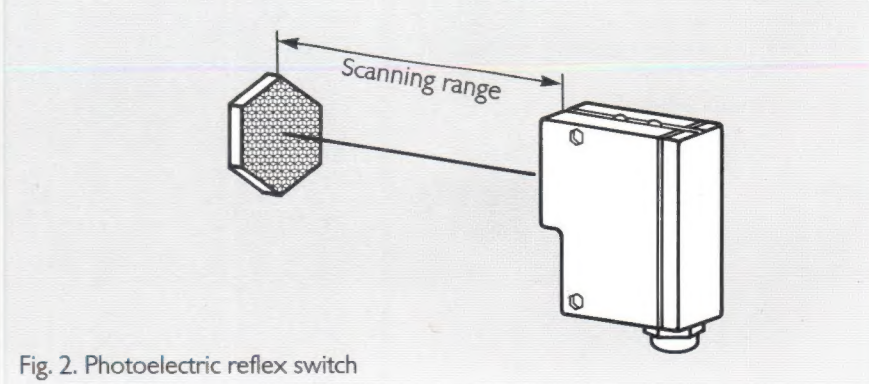


Fig. 2. Photoelectric reflex switch

Photoelectric Proximity Switch
Photoelectric Fiber-optic Switch
Contrast Scanner

Photoelectric Proximity Switch

With a proximity switch (e.g. WT 27), unlike the reflex switch, the light is reflected by the material itself. The beam is focussed to increase the sensitivity of the system. Materials with a matt black surface, with a reflectance of at least 6 %, can be reliably detected. In simple cases, the scanning distance can be "tuned" by reducing the sensitivity (sensitivity control), but it is more effective to adjust the scanning distance mechanically or geometrically. This facility is offered by proximity switches equipped with background suppression.

Angular reflection scanners are devices which have a particularly wide angle between light source and light receiver system. To achieve greater switching accuracy, the beams are focussed at the point of intersection of source and receiver.

One special version of photoelectric proximity switches is constituted by registration control scanners, which are particularly suitable for the packaging industry. In such cases, particular attention should be paid to light spot orientation and to the direction of relative movement between proximity switch and the material being scanned.

See Fig. 3

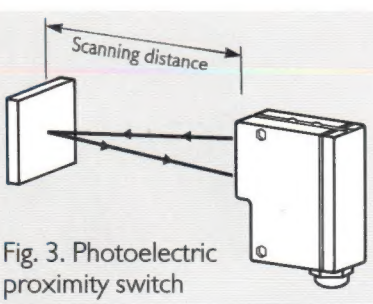
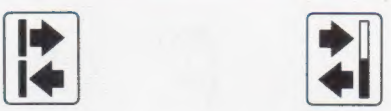


Fig. 3. Photoelectric proximity switch

Photoelectric Fiber-optic Switch

In photoelectric fiber-optic switches (e.g. WLL 10), the light source and light receiver are located in the same housing. By means of flexible optical cables of plastic or glass fiber design, the operating location of the device is transferred away from the operating area that is inaccessible to photoelectric switches or proximity switches. Fiber-optic cables can therefore be advantageously employed under unfavourable conditions, e.g. at temperatures as high as +300°C, in the presence of heavy vibration or aggressive substances.

Contrast Scanner



Contrast Scanners work according to the photoelectric proximity switch principle and are capable of detecting up to 15 different gray scale values between black and white. This characteristic is a prerequisite for reading contrasting marks (e. g. printed coloured marks). In general, colours differ in their respective gray scale value (brightness value). The difference in the brightness of the mark and that of the background - not the colour contrast - is the decisive criterion for readability.

A light source, a LED or an incandescent lamp produces a spot of light at the scanning distance (focus). The reflectance of this surface is evaluated in the contrast scanner. The actual brightness value of the material surface is continuously compared with a preset threshold value (gray scale value). As soon as this switching threshold is exceeded or remained, the switching output changes.

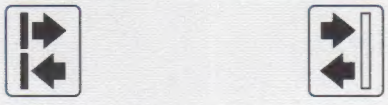
Luminescence Scanner
Distance Measuring Device
Temperature Measuring Instruments

Luminescence Scanner

Practical requirements ought actually to be met by a photoelectric proximity switch. This is certainly true in normal cases, but other problems may occasionally arise: for example, a registration mark on an irregular background, e.g. on grained wood, may not be read reliably; "matching shades" also present a standard photoelectric proximity switch with insurmountable reading problems. In such cases, a luminescence scanner (e.g. LUT 1-4) may help. This reacts only to luminescent materials which have been activated by the UV light source in the scanner. Luminescent pigments can be added to the material being scanned or be applied in the form of coloured marks, e.g. chalk.

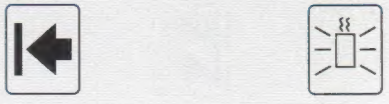
See Fig. 4.

Distance Measuring Device



The DME 2000 Distance Measuring Device is a high-precision opto-electronic instrument. It measures the transit time of light according to the phase correlation principle using a semiconductor laser which complies with laser class 2. An 8-digit display indicates the measured values; further external processing of the data is realized via a serial interface or an analogue current output. Two switching outputs, with both the switching hysteresis and threshold being selectable at will, undertake direct control functions. A user-friendly menu guidance allows adaptation of the parameters to every individual application in automation without any problem.

Temperature Measuring Instrument



The TM 20 is a safe solution to all situations where non-contacting detection and measurement of temperatures is required. It allows immediate and adequate intervention in the event of limit value infringements. The TM 20 reliably and quickly provides the measured values - for control, regulation and the temperature measurement of objects which may be small, big, moving or stationary.

Three different versions are available to match with individual applications which differ in the temperature range, the ambient temperature and the respective position. With regard to the required temperature range, the TM 20 is equipped with a Thermopile, a PbSe, PbS or a Ge sensing element.

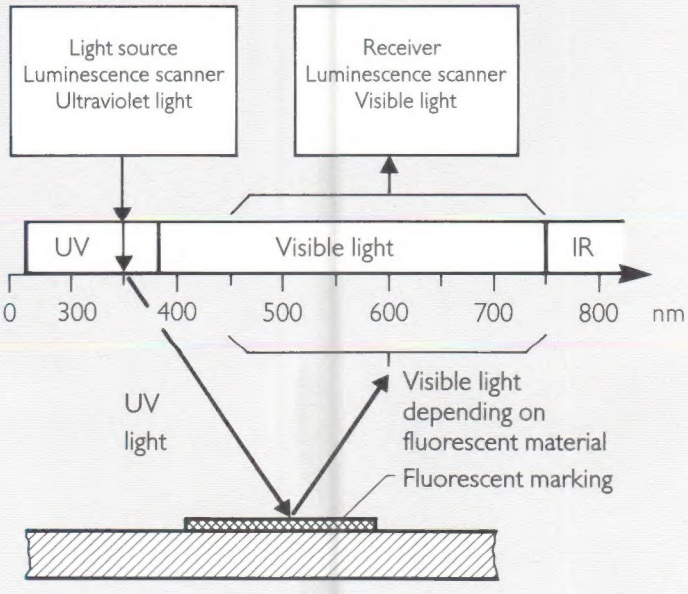


Fig. 4. Luminescence scanner

WT 18 Photoelectric Proximity Switch used for the control of lid catches in margarine packaging

Through-beam Photoelectric Switches

Model	Scanning range	m	5	12	25	50	100
	WS 5 / WE 5	1.5					
	WS 6 / WE 6		5				
	WS 9 / WE 9		5				
	WS / WE 18			12			
	WS 27 / WE 27				25		
	WS 36 / WE 36					50	
	WS 45 / WE 45						100
	WS / WE 12			10			
	SP 10 / EP 10	2					
	WS / WE 260			20			
	VS / VE 180			15			
	WSU 26 / WEU 26				30	60	

Photoelectric Reflex Switches

Scanning range	m	1	2	3	4	8
WL 6	0.1		2			
WL 9			2			
WL 18					4	
WL 27					4	
WL 36	0,1					10
WL 45						45
WL 12				3		
LP 10	0,65					
WL 260	0.01				5	
VL 180	0.05			3		
WL 25 Ex i						25

Photoelectric Proximity Switches

Scanning distance	mm	20	150	300	800	2000
WT 5	100					
WT 6				300		
WT 9	10	20				
WT 18	20		50 to 150			
WT 27		30		100 to 300		
WT 36		40			200 to 800	
WT 45			200		400 to	2000
WT 32		100				2000
WT 30	15 ... 30			100 to 300		
WT 12 VGA		35	100			
WT 12 HGA	20		130			
WT 12		80		400		
WT 12 (contrastsc.)		13.5				
WT 260					800	
VT 180				400		
WT 25 Ex i	10				1000	
RP 1-11[5]	9.5					

Photoelectric Fiber-optic Switches

Scanning range	mm	25	50	100	150	200
WLL 5		40				
WLL 6					150	
WLL 10					200	

1) VMA = Contamination signalling output 2) FS = Foreground suppression 3) BS = Background suppression

Selection Table
Through-beam Photoelectric Switches
Photoelectric Reflex Switches
Photoelectric Proximity Switches
Photoelectric Fiber-optic Switches

Equipment						Supply voltage		Output			Connection			Page
Polariz. filter	Test input	VMA[1]	FS[2]	BS[3]	Time delay	DC	AC/DC	PNP	NPN	Relay	Plug	Ter-minals	Cable 2 m	
Not required	–	–	Not required	–	–	12 to 24 V	–	●	●	–	–	–	●	32
	–	–		–	–	12 to 24 V	–	●	●	–	–	–	●	40
	●	–		–	–	10 to 30 V	–	●	●	–	–	–	●	54
	●	–		–	–	10 to 30 V	–	●	●	–	●	–	●	62
	●	●		–	●	10 to 30 V	24 to 240 V	●	●	●	●	–	–	70
	●	●		–	●	10 to 30 V	24 to 240 V	●	●	●	●	●	–	78
	●	●		–	●	10 to 60 V	24 to 240 V	●	●	●	●	●	–	86
	●	–		–	–	10 to 30 V	–	●	●	–	●	–	●	102
	–	–		–	–	10 to 30 V	3 V/1.5 V (lamp)	●	●	–	–	–	●	118
	●	●		–	●	10 to 30 V	–12 to 240 V/~24 to 240 V	●	●	●	–	●	–	128
	●	–		–	–	10 to 30 V	~20 to 264 V	●	●	–	●	–	●	136
	●	–		–	–	–	~42/48, ~110/120, ~220/240	–	–	●	●	●	–	195
	–	–	Not required	–	–	12 to 24 V	–	●	●	–	–	–	●	42
	●	–		–	–	10 to 30 V	–	●	●	–	–	–	●	56
	●	●		–	–	10 to 30 V	–	●	●	–	–	–	●	64
	●	●		–	●	10 to 30 V	24 to 240 V	●	●	–	–	–	●	72
	●	●		–	●	10 to 30 V	24 to 240 V	●	●	●	●	●	–	80
	●	●		–	●	10 to 60 V	24 to 240 V	●	●	●	–	●	–	88
	●	●		–	–	10 to 30 V	–	●	●	–	●	–	●	104
	–	–		–	–	10 to 30 V	3 V/1.5 V (lamp)	●	●	–	–	–	●	120
	●	●		–	●	10 to 30 V	–12 to 240 V/~24 to 240 V	●	●	●	–	●	–	130
	●	–		–	–	10 to 30 V	~20 to 264 V	●	●	–	●	–	●	138
	–	–		–	–	5 to 13,5 V	–	●[4]	●[4]	–	–	●	–	202
Not required	–	–	–	–	–	12 to 24 V	–	●	●	–	–	–	●	34
	–	–	–	–	–	12 to 24 V	–	●	●	–	–	–	●	44
	–	–	–	–	–	10 to 30 V	–	●	●	–	–	–	●	58
	–	–	–	●	–	10 to 30 V	–	●	●	–	●	–	●	66
	●	–	–	●	●	10 to 30 V	24 to 240 V	●	●	–	●	–	●	74
	●	–	–	●	●	10 to 30 V	24 to 240 V	●	●	●	●	●	–	82
	●	–	–	●	●	10 to 60 V	24 to 240 V	●	●	●	–	●	–	90
	●	●	–	–	●	10 to 30 V	24 to 240 V	●	●	●	●	●	–	93
	–	–	–	●	●	10 to 30 V	–	●	●	–	–	●	●	97
	–	–	●	–	–	10 to 30 V	–	●	●	–	●	–	●	108
	–	–	–	●	–	10 to 30 V	–	●	●	–	●	–	●	110
	–	–	–	–	–	10 to 30 V	–	●	●	–	●	–	●	112
	–	–	–	–	–	10 to 30 V	–	●	●	–	●	–	–	114
	●	●	–	–	●	10 to 30 V	–12 to 240 V/~24 to 240 V	●	●	●	–	●	–	132
	–	–	–	–	–	10 to 30 V	~20 to 264 V	●	●	–	●	–	●	140
	–	–	–	–	–	5 to 15,5 V	–	●[4]	●[4]	–	–	●	–	204
	–	–	–	–	–	10 to 30 V	3 V (lamp)	–	●	–	–	–	●	209
	–	–		–	–	12 to 24 V	–	●	●	–	–	–	●	36
	–	–		–	–	12 to 24 V	–	●	●	–	–	–	●	46
	–	–		–	–	10 to 30 V	–	●	●	–	–	–	●	123

4) Status-dependent control current 5) Angular reflection scanner

Selection Table
Contrast Scanners, Luminescence Scanners
Distance Measuring Devices
Temperature Measuring Instruments

Model	Scanning distance mm	Equipment			Power Supply		Output					Type of Connection		Page
		Time delay	Autom. sensitivity adjustment	Blanking	DC	AC/DC	PNP	NPN	Relay	B	Analog	Plug connector	Cable	
NT 6	9, 18	●	–	–	10 to 30 V	–	●	●	–	●	●	–	●	164
NTL 6	0,5 to 5 (Scanning distance) 0 to 60 (Scanning range)	●	–	–	10 to 30 V	–	–	–	–	●	●	●	●	166
NTA 6	9, 12.5, 18	–	●	●	10 to 30 V	–	–	–	–	●	–	●	●	170
NT 8	9, 18	–	–	–	10 to 30 V	4.5 V	●	●	–	–	–	●	●	172
LUT 1–4	8 to 300 8 to 14 (with fiber-optic cable)	–	–	–	18 to 30 V	–	●	–	–	–	●	●	–	186
LUT 1–5	8 to 125 8 to 14 (with fiber-optic cable)	●	–	–	18 to 30 V	–	●	●	–	–	●	●	–	188

DME 2000	Scanning distance/Scanning range	Supply voltage	Page
Mod. 1	100 to 2000 mm	DC 18 to 30 V	219
Mod. 2	0.1 to 130 m	DC 18 to 30 V	219

Model	Temperature range	Min. size of object	Distance	Supply-Voltage	Cable	Page
TM 20-1	0 to 500°C / 150 to 500°C	ø 4 mm / 32 mm, 2 mm / 20 mm	50 mm / 500 mm 50 mm / 500 mm	DC 12 to 24 V	●	222
TM 20-2	0 to 500°C	4 mm / 32 mm	50 mm / 500 mm	DC 12 to 24 V	●	224
TM 20-3	400 to 800°C / 600 to 1200°C / 1000 to 2000°C	12 mm	200 mm	DC 12 to 24 V	●	226

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What SENSICK has to offer

Tests are carried out periodically – in most cases prior to major runs – to check the operational readiness of a control system. The test can take the form of switching the supply voltage of the optical sensor on and off.

This kind of test has two drawbacks, however: in the case of optical/electronic devices, the optical operating range is not monitored; with devices equipped with power-up false-triggering suppression, the suppression period has to be taken into account. It is basically true that electronic components for overvoltage protection, polarity-reversal protection and power-up false-triggering suppression are heavily loaded in this type of testing.

Modern photoelectric switches and proximity switches have a separate test input. In such devices the light source is switched on and off almost without power. Photoelectric switches can be tested when the beam is uninterrupted (no obstacle in the path of the beam), and photo-electric proximity switches when there is an object with a defined reflecting property in the range of visibility of the proximity switch (Figs. 1 to 4). By switching the light source, it is possible to monitor the entire optical system and the complete electronics and leads, including the test lead. Testing is possible on the direct-voltage versions of the devices:

WL 18, WL 27, WL 36, WL 45,
WT 27, WT 36, WT 45,
WS/WE 9, WS/WE 12, WS/WE 18, WS/WE 27, WS/WE 36 and WS/WE 45.

If no testing is required, the test input can also be used to interconnect devices. Series and parallel connections can be executed in the form of logic operations (see Networking Capability).

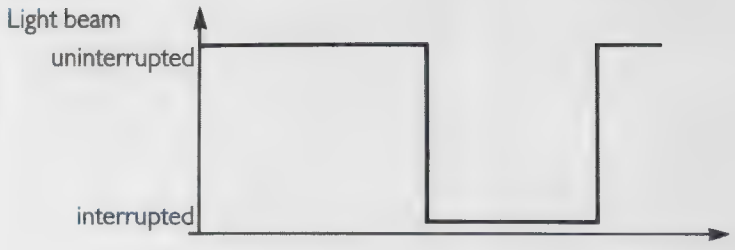


Fig. 1.
The optical signal at photoelectric reflex or proximity switch

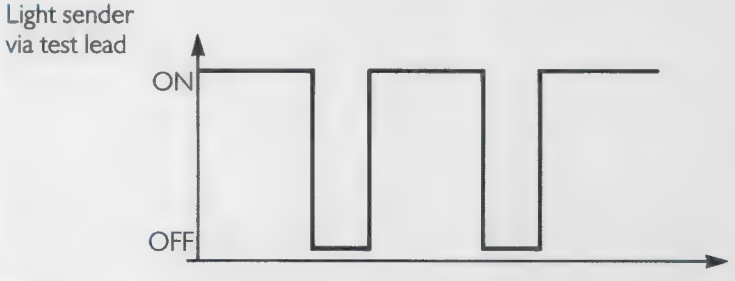


Fig. 2.
Switching function of light sender during test (disconnection)

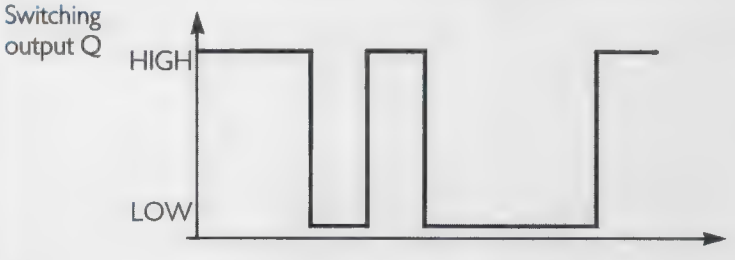


Fig. 3.
Switching behaviour of transistor output Q when testing: uninterrupted and interrupted beam

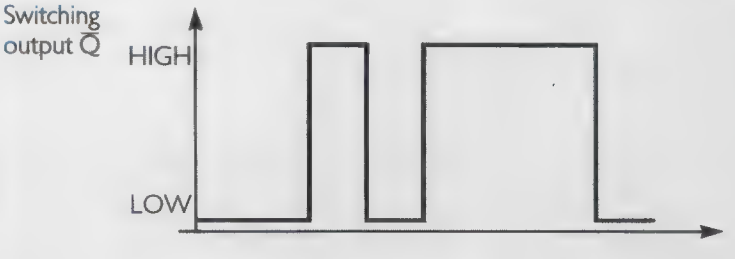


Fig. 4.
The inverse switching behaviour of transistor ouput $\overline{Q}$ for testing: uninterrupted beam and interrupted beam

Networking Capability

In certain applications it can be an advantage to achieve simple logic operations for photoelectric switches and proximity switches without special logic modules ("wired OR" principle).

There are no problems with series and parallel connection of devices with (electrically isolated) relay contacts (Fig. 1). The situation is rather more complicated in the case of direct-voltage devices with transistor outputs in NPN, PNP and B configurations.

Electrical ground-rules must be observed when gating electronic switching outputs:

- Only NPN or PNP switching outputs can be combined with each other (Fig. 2).
- B switching outputs can neither be connected in series nor in parallel.
- Because of the relatively high making current, the supply voltage of modulated-light devices can only be conditionally switched by short-circuit protected switching outputs.

Parallel Connection

The number of direct-voltage-supply photoelectric switches and proximity switches which can be connected in parallel is governed by the following parameters:

a) Supply voltage (e.g. 30 V)
b) Internal pull-up and pull-down resistances (approx. 10 kΩ)
c) Max. permissible switching current of switching output Q (e.g. 200 mA)
d) Current consumption of load at device output (e.g. relay with 50 mA)

(a) and (b) produce a basic load of

$$\frac{30\ V}{10\ k\Omega} = 3\ mA$$

The switching output of each individual device should be capable of switching the basic load (3 mA) as well as the relay (e.g. 50 mA). The max. number of transistor outputs which can be connected in parallel can be calculated from:

$$SUM = \frac{I_{Qmax} - I_{Rel}}{I_{Pull}}$$

$$= \frac{200 - 50\ (mA)}{3\ (mA)} = 50$$

Under the conditions assumed, up to 50 devices can be connected in parallel (Fig. 3).

Series Connection

When photoelectric switches are connected in series, the supply voltage of one switch is switched by the switching output of the preceding switch. Modern switching outputs are generally provided with very quick-acting short-circuit protection or with an overload fuse – with a response threshold between 150 and 250 mA. Modulated- light devices, on the other hand, require a relatively high making current: of the order of 500 mA to 2000 mA for a duration of a few milliseconds. Switching the supply voltage is consequently impossible.

Devices with Test Input

The operational readiness of a photoelectric switch can be switched via the test input. If the test input of one switch is switched by the transistor output of the preceding switch, a series connection is hereby produced (Fig. 4).

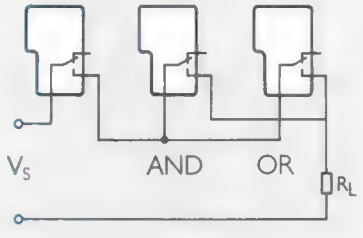


Fig. 1.
Problem-free series and parallel connection of relay-type photo-electric switches

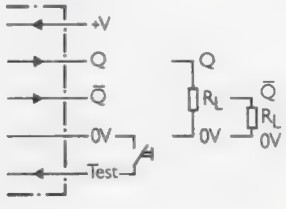


Fig. 2.
Connection diagram of PNP device

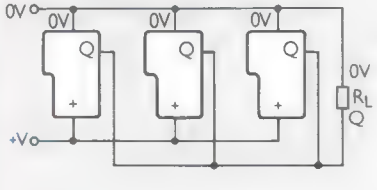


Fig. 3.
Parallel connection of three PNP devices

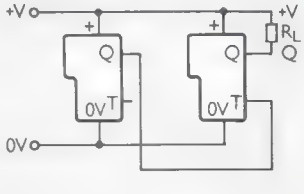


Fig. 4.
Series connection in conjunction with test input

Timing Elements

The switching outputs of optical/ electronic devices directly follow the optical conditions – with the appropriate system-determined time delays.

Because of the high speed of the optical principle, false information can be produced by brief interruption of the beam in the case of through-beam or reflex photoelectric switches, as well as by brief detection of objects by photoelectric proximity switches. A series- connected relay may not be given sufficient time to switch, or the electronics may require a certain pulse duration to increase interference immunity (Fig. 2).

To permit individual matching in this connection, devices with timing elements are available: from devices size W 27 onwards they can also have programmable time delays. These time delays can be selectively switched to ON-delay or OFF- delay (Fig. 3) and, according to the version, can be finely adjusted from 0.015 to 0.35 s or from 0.5 to 12 s.

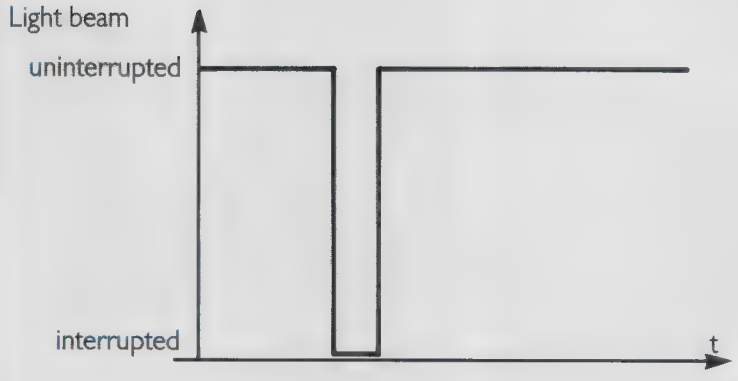


Fig. 1.
Brief beam interruption

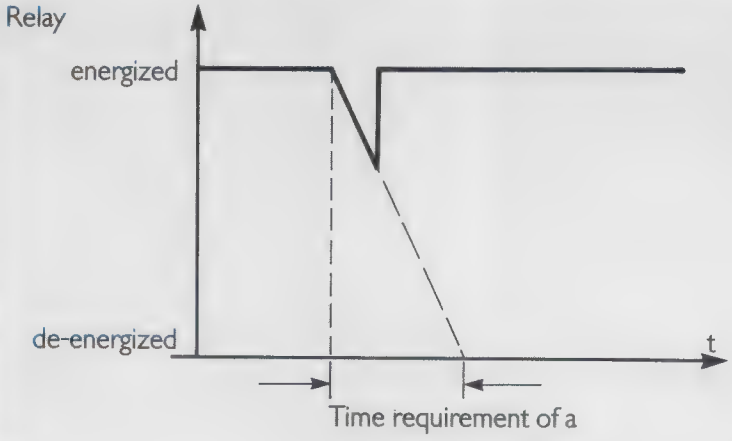


Fig. 2.
Beam interruption too short to cause relay to drop out.

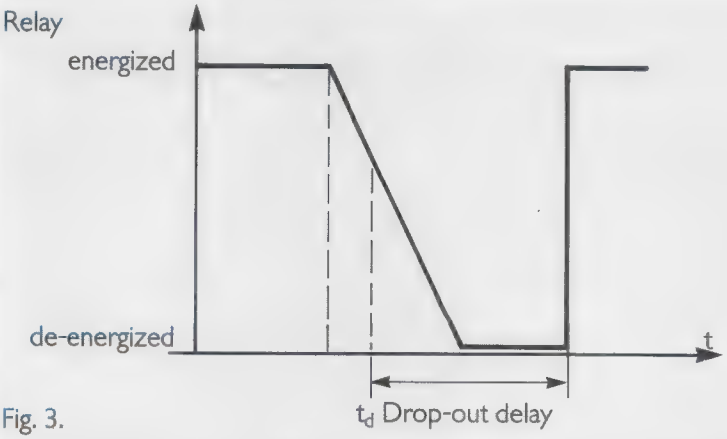


Fig. 3.
A photoelectric switch with timing element and programmable relay energizing and de-energizing delay enables the relay contacts to be reliably switched, even for short beam interruptions.

Insensitivity to Ambient Light through Interference Suppression

Photoelectric switches and proximity switches operate using the light they themselves emit. It is impossible in practice to prevent daylight or light from external sources reaching the light receivers. This light is "ambient" light. Sources of radiation may emit incandescent (continuous) light or modulated light. If the power of the radiation is of an appropriate order, photoelectric switches working with incandescent-light systems may be influenced both by incandescent and modulated light (Fig. 1). The interference can usually only be reduced by screening the ambient light.

Compared with incandescent-light systems, devices employing modulated-light systems are more secure by several factors in relation to ambient light, especially to daylight, incandescent lamps or common fluorescent lamps (Fig. 2). With SENSICK devices, security in relation to ambient light is further increased by interference suppression.

In interference suppression, the light receiver is coupled to the light-sender electronics: the receiver is in fact only ready to receive while a light pulse is being transmitted. In the intervals between pulses, the receiver is "blanked", i.e. it ignores all optical and electronic interference pulses.

The method has its limits: multiple interference suppression has therefore been developed to counter extreme stray light in a high-frequency, high-energy form. This applies to series 9, 18, 27, 36 and 45 photoelectric switches and proximity switches.

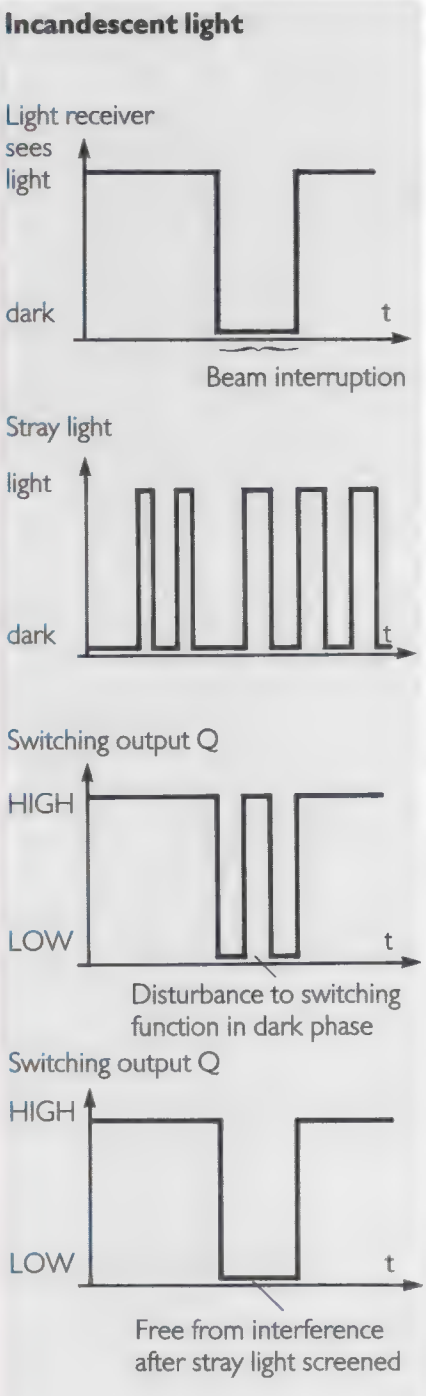


Fig. 1.
Photoelectric switches employing incandescent-light systems react to ambient-light pulses when light receiver sees "dark".

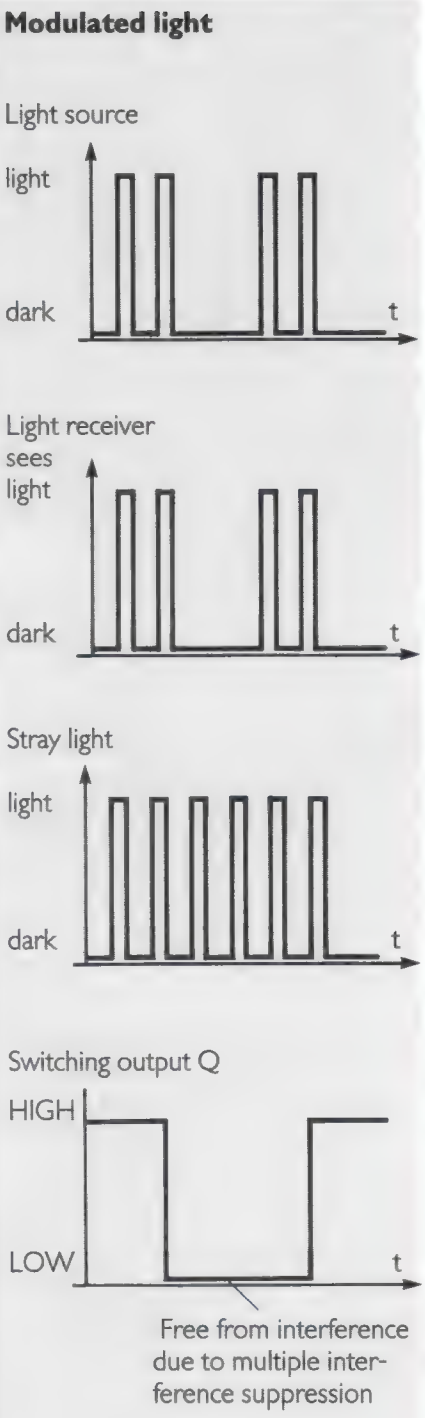


Fig. 2.
With modulated-light switches equipped with interference suppression, the light receiver is also switched off in the dark phase of the light source. Interference is therefore effectively suppressed.

Short-circuit protection

Whereas photoelectric switches with relay outputs can work - according to the loading capacity of the contacts - strong currents, the capacity of electronic outputs is limited.

The outputs of SENSICK photoelectric switches are most efficiently short-circuit protected: While operating, the output current is continuously measured. If the current exceeds the maximum value the integrated electronics checks the state of the output. The latter is activated for a short instant to check if the overload still exists.

If the output is in normal condition the photoelectric switch will return immediately into the normal operating mode.

Due to this most effective electronic protection, it is not possible to connect the output signal to the input of another photoelectric switch.

Electronic devices require a very strong current for the moment of switching on. This current is much stronger than the nominal current consumption indicated in the data sheets. The electronic short-circuit protection prevents this currents from damaging or overloading the output transistors.

Enclosure rating

Characteristic letter and number: Protection against electric shock and foreign bodies

2nd Characteristic number: Protection against the penetration of liquids

Protection against	No protection	Trickling water vertical	Trickling water inclined	spray-water	splash water	hose	flooding	dipping	immersion
IEC 529 DIN 40050	IP ..0	IP ..1	IP ..2	IP ..3	IP ..4	IP ..5	IP ..6	IP ..7	IP ..8
IP 0.. No protection	IP 00								
IP 1.. Max. size of the foreign body: 50 mm	IP 10	IP 11	IP 12						
IP 2.. Max. size of the foreign body: 12 mm	IP 20	IP 21	IP 22	IP 23					
IP 3.. Max. size of the foreign body: 2.5 mm	IP 30	IP 31	IP 32	IP 33	IP 34				
IP 4.. Max. size of the foreign body: 1 mm	IP 40	IP 41	IP 42	IP 43	IP 44				
IP 5.. Dust	IP 50			IP 53	IP 54	IP 55	IP 56		
IP 6.. Dust	IP 60					IP 65	IP 66	IP 67	

The main criterion with photoelectric switches is the scanning distance.

If the environment is excessively dusty, after a long period of exposure, this value may no longer be sufficient: – dust settles on the photoelectric switch and on the reflector (Fig. 1). If the reduction in light transmission due to dirt accumulation on any (boundary) surface is a uniform 20 % (visually hardly perceptible, without direct comparison), the received light signal strength will, because of the double penetration of the dust layer, represent only about 40 % of the light available in a clean condition. The complete safety margin is thereby used up and the value falls below the switching threshold.

In order to provide the user with warning of imminent breakdown of the photoelectric-switch system, SENSICK devices are equipped with a contamination control. If the received light signal strength is less than 50 % above the switching threshold (factor of 1.5), the signal strength indicator starts to blink at 5 Hz (Fig. 2).

Devices such as WL 36, WL 45, WL 260, WS/WE 27, WS/WE 36 and WS/ WE 45 additionally offer a signalling output which is independent of the switching outputs. Remote monitoring is thereby also a possibility.

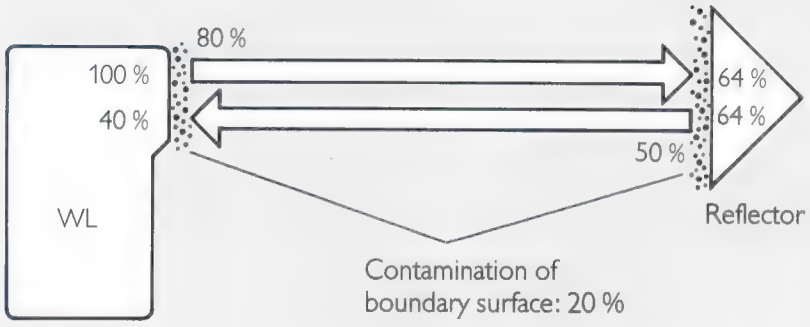


Fig. 1.
Even relatively little contamination on the optics can completely use up the safety margin.

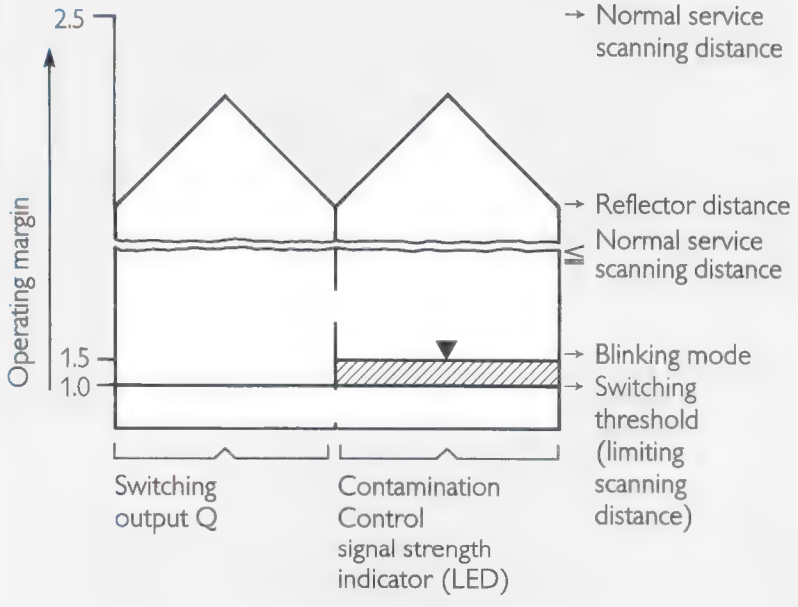


Fig. 2.
While the switching operation still exhibits a defined switching behaviour, the blinking mode signals entry into the safety margin (with an operating-margin factor of less than 1.5).

Alignment aid

Among others, reliable functioning of photoelectric switches and photoelectric proximity switches depends on correct alignment. Therefore with through-beam photoelectric switches, the sender must be aligned with the receiver element. Photoelectric reflex switches are aligned with a reflector. When using a photoelectric proximity switch, the object must be positioned in the reception range. SICK photoelectric switches are aligned by means of an optical or an electronic alignment aid.

The alignment sight on the upper side of the photoelectric switch is the most simple aid and it is used for coarse adjustment. Then, precise alignment is carried out by electronic means. A LED signals correct adjustment. Following coarse alignment, the photoelectric switch is moved in such a way (the light path being uninterrupted) that the LED is permanently lit. Turning the photoelectric switch helps to find out the range of correct alignment since the LED starts blinking as soon as this area has been left. If the photoelectric switch is moved further away from this area the LED switches off. Accurate alignment is just between the two blinking positions. Photoelectric proximity switches are adjusted in the same way. An object, however, is required for alignment.

A further aid is the visible red light. The red sender light which is emitted by photoelectric proximity switches is focussed at an object whereas the red light emitted by photoelectric reflex switches is reflected by the reflector. An alignment sight, however, is not adequate aid for the coarse alignment of photoelectric switches with great scanning ranges, e. g. the WS/WE 45 with a 100-m scanning range. Hence, these models are equipped with a special alignment optics similar to that of cameras. This optics allows relatively accurate alignment even at greater distances.

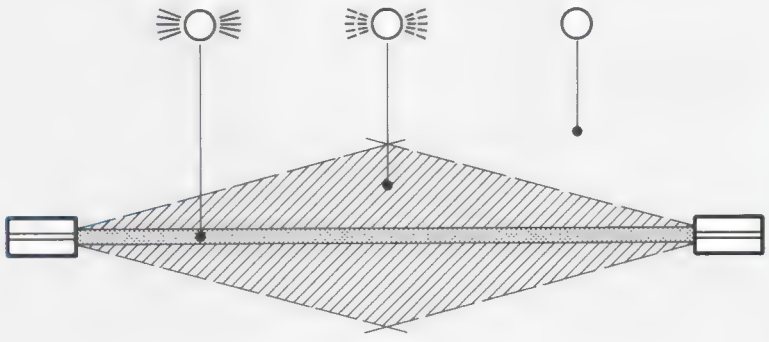


Fig. 1. A permanently lit indicator signals correct alignment. Slight misalignment is signalled by blinking, the indicator switches off with total misalignment.

No False Triggering on Power-up

Switch-on of an electronic device should not be equated with instantaneous normal function (Fig. 1). During the switch-on process, the electronics pass through certain operational states which may, at least briefly, be caused to operate abnormally by a spurious pulse. In many devices, however, this is absolutely necessary. During the switch-on process, no false statement must be issued at the output (Fig. 2). The phrase describing the internal arrangement which prevents this is "No false triggering on power-up". It forces release of the output and consequently acceptance of the optical input conditions only after normal operation of the device. Functions of a plant control system can therefore never be initiated at the wrong time, and time controls encountered in practice are not improperly started. The process takes time: up to 70 ms (Fig. 3), which must be taken into account when test-switching the supply voltage.

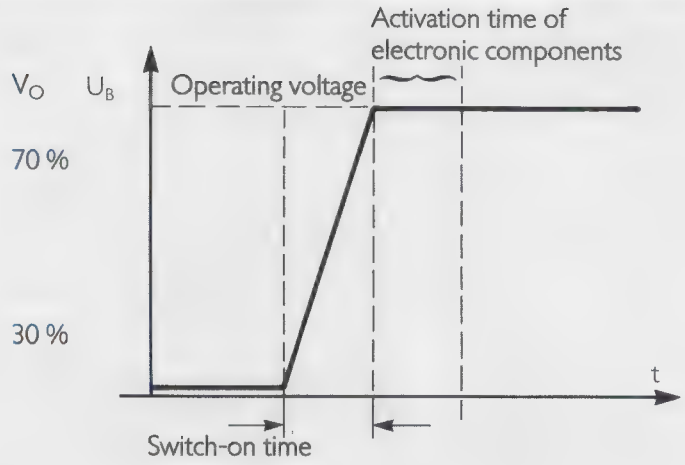


Fig. 1.
Application of an operating voltage

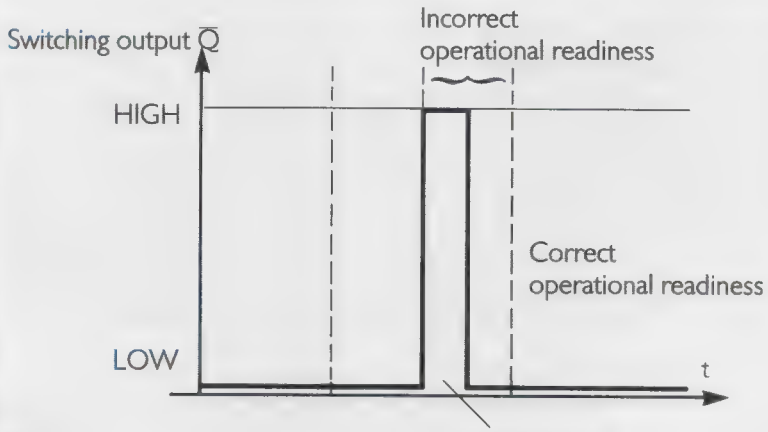


Fig. 2.
Devices without power-up false-triggering suppression
Switching output $\overline{Q}$; possibly incorrect signal behaviour

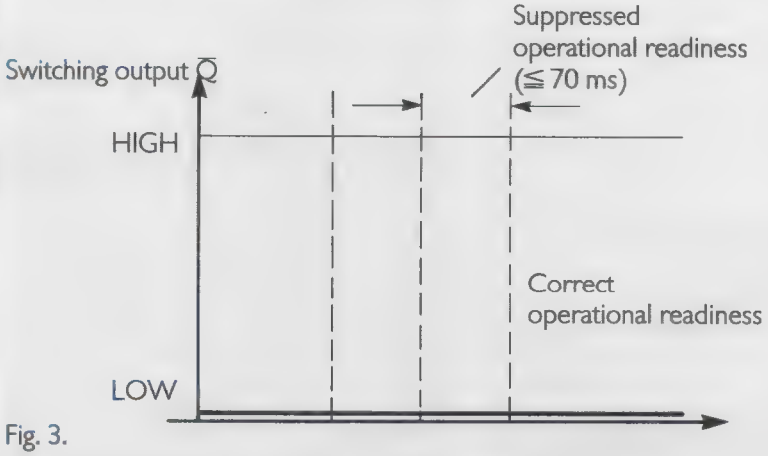


Fig. 3.
Devices with power-up false-triggering suppression
Switching output $\overline{Q}$ with reliable signal behaviour

Explosion Protection

Wherever combustible substances and liquids are produced, transported, processed and stored, an explosive atmosphere can be produced, constituting a danger to humans and property. The essential prerequisites for an explosion are:

- combustible substances (gas; dust; vapour; mist)
- oxygen (air)
- ignition source (sparks; temperature).

To protect humans and property, design specifications exist for devices used in areas prone to explosions. Areas with explosive atmospheres (due to gases, vapours or mists) are divided into "zones" according to the likelihood of an explosion (Fig. 1):

Zone 0	Explosive atmosphere present continuously or for long periods
Zone 1	Explosive atmosphere occasionally present
Zone 2	Explosive atmosphere rarely or briefly present

The following zones apply to explosive atmospheres due to dust:

Zone 10	Explosive atmosphere present for long periods
Zone 11	Explosive atmosphere occasionally present

In zones 0, 1, 10 and 11, only equipment (including photoelectric switches and proximity switches) having a Certificate of Conformity may be used (e.g. WL 25-Ex i for zones 1 and 11).

Use of Fiber-optic Cable Systems

When fiber-optic cable systems (WLL 6; WLL 10; NTL 6; LUT 1-5 with fiber-optic cable) are used in areas prone to explosions, the following points must be borne in mind (Fig. 2):

- exclusively fiber-optic cables in the area prone to explosions
- installation of associated optic-electronic modules outside the area prone to explosions
- sealing of fiber-optic cable bushing in accordance with DIN/ VDE 57165, section 5.6.2 (Fig. 2).

If the above installation recommendations are followed, the fiber-optic cable systems are suitable for use in all explosion-protection zones (0, 1, 2, 10 and 11).

In a class-2 zone, devices without a Certificate of Conformity can also be used, e.g. series 12, 18, 27, 36 and 45 from the SENSICK series, or NT 6 and NTL 6 registration control scanners. When the devices are installed using a plug, a plate warning "Do not remove/insert plug under load" must be fitted near the plugs. In addition, the leads employed should have a minimum cross-section of 0.5 mm^2 (see DIN/ VDE 57165). Selection according to temperature classes (T 1 to T 6) should also take place. Devices in the SENSICK P series, NT 6 and NTL 6 can be used for a max. of T 4.

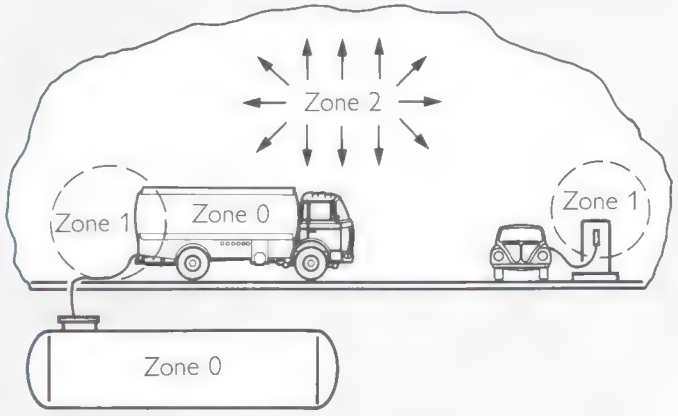


Fig. 1.
Different areas with an explosive atmosphere

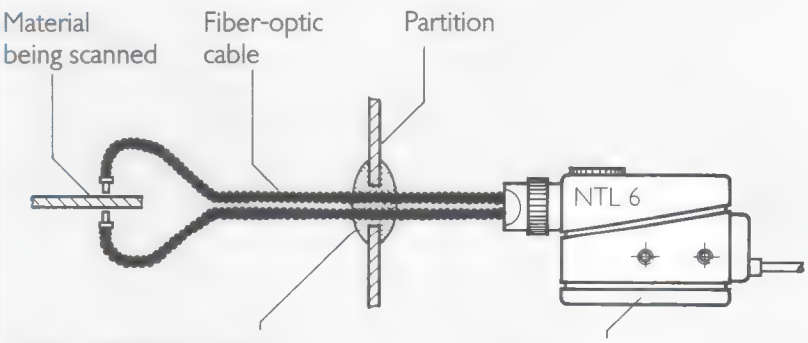


Fig. 2.
Only the fiber-optic cables are in the area prone to explosions. It is suitable for protective zones 0, 1, 2, 10 and 11.

Polarizing Filters

Photoelectric reflex switches work in conjunction with special retro-reflectors. The devices are designed to react only to these reflectors and to detect them as "light". If the light beam between reflex switch and reflector is interrupted by an obstacle, the switch should signal "dark". The obstacles may be objects with very varied surfaces, even mirror-bright special steel or aluminium, or tin containers and metal foils.

A photoelectric switch cannot normally differentiate between the reflected light from a reflective surface and the reflection from a reflector. This leads to maloperations. The situation can be alleviated by fitting a polarizing filter.

Function of a Polarizing Filter

The light emitted from ordinary light sources, e.g. incandescent lamps and LEDs, oscillates in an arbitrary plane. This light is guided by a polarizing filter, a "striped" filter. Beyond the filter, the light oscillates only in the direction of the stripes, i.e. horizontally, for example (Fig. 1). With an uninterrupted beam, the horizontally oscillating light strikes the reflector. The reflectors recommended by SICK behave in an optically active manner, i.e. they rotate the polarization axis through 90°. The beam is no longer able to return through the polarizing filter used at the exit.

A further polarizing filter is arranged in front of the receiver part of the photoelectric switch. This filter is turned through 90° in relation to the light-source filter – corresponding to the reflected beam.

Consequently, no horizontally polarized light can reach the receiver, such as is reflected by a simple-reflection "normal" glossy material. Any material which does not rotate the polarization plane is detected as an obstacle (Fig. 2).

Limits of Mirror Reliability

Photoelectric switches in the SENSICK series are not disturbed by surface reflections. Problems are experienced with optically transparent materials, however, such as Perspex (Plexiglas/Lucite) lids, laminated foil or foil transitions. It is not the surface gloss that causes trouble, but the reverse side of the transparent material. By virtue of their molecular structure, Perspex (polymethyl methacrylate resin) and other optically clear foils exhibit the property of polarization-plane rotation: the polarized light from the source, when it penetrates the foil medium, may be turned through 45° compared with its original direction of oscillation. Reflected by the reverse side of the material, it passes through the material with a further 45° rotation. The total rotation is therefore 90° or a multiple of 90°. In this case, the photoelectric switch may respond in an unacceptable manner (Fig. 3). The effect of the disturbance is relatively small, however. It can be eliminated by reducing the system sensitivity slightly (turning the sensitivity controller). A further improvement can be achieved by changing the scanning angle of the photoelectric switch in relation to the surface of the object.

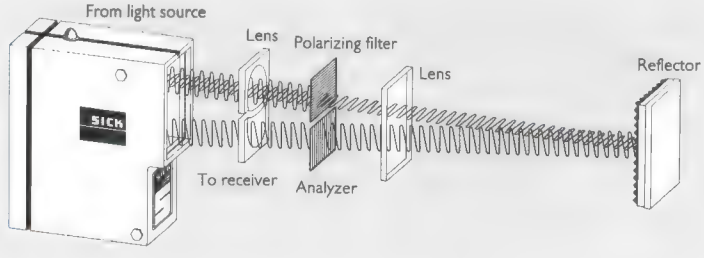


Fig. 1.
Mode of operation of polarizing filter

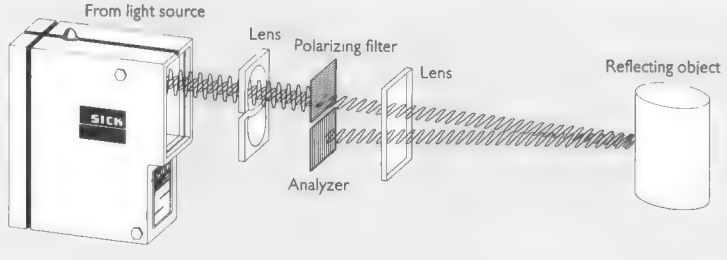


Fig. 2.
Reflection from object

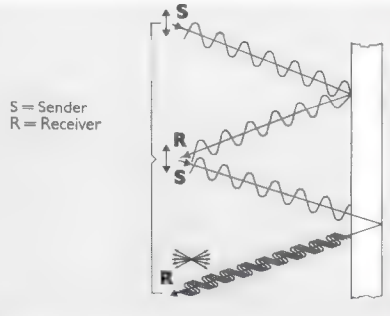


Fig. 3.
Behaviour of optically active materials

Foreground suppression

When using a photoelectric proximity switch, foreground suppression may be necessary in some cases. Fig. 1 shows the assembly. There is one element for the distant range and two for the short range.

The photoelectric proximity switch has become a widespread measuring instrument. The different versions, e. g. as an energetic proximity switch or with background suppression are used for numerous purposes. But all systems known so far depend on the surface quality of the object: big differences in the surface reflectance may lead to faulty measurement and even make the use of proximity switches doubtful.

Therefore, foreground suppression has been developed to ensure safe and reliable functioning of the photoelectric proximity switches even in problematic applications for example. A comparatively flat object with an irregular surface reflectance needs to be detected, positioned or counted on a conveyor.

Due to its scanning method, a photoelectric proximity switch would not be capable of detecting the object on the conveyor. The photoelectric proximity switch with background suppression is not capable of making a distinction between the background, i. e. the conveyor, and the object; the irregular surface reflectance would lead to faulty measurement.

A photoelectric proximity switch with foreground suppression is the solution to this problem. The conveyor, for example, is used as a reflecting material. Contrary to normal functioning, the photoelectric proximity switch detects an interruption of the light beam produced by the conveyed object and operation is unaffected by the reflective properties of the material.

Functioning

Photoelectric proximity switches work with visible light thus ensuring good visibility of the light spot on the material as well as accurate adjustment. Highest switching accuracy is obtained in the focus area of the beam of sender light. For adjustment, the scanning distance is reduced until the instrument switches. The signal strength indicator is lit. If the object, which is to be detected, is moved in the light path, the signal strength indicator goes off.

System Structure

The photoelectric proximity switch with foreground suppression works with a focussed beam of sender light (smallest diameter of light spot at a scanning distance of approx. 60 mm) and is equipped with a pivoting mirror for the receiving element. This deflecting mirror allows adaptation of the proximity switch to the scanning distance without changing the sensitivity of the system. Proximity switches with foreground suppression provide high switching accuracy since there is a greater distance between the sender and the receiver element.

Advantages

- Visible red light
- Insensitive to heavily contrasting objects
- High switching accuracy in the focus (2mm with a scanning distance of 60 mm)
- Big adjustment range (35 to 100 mm)

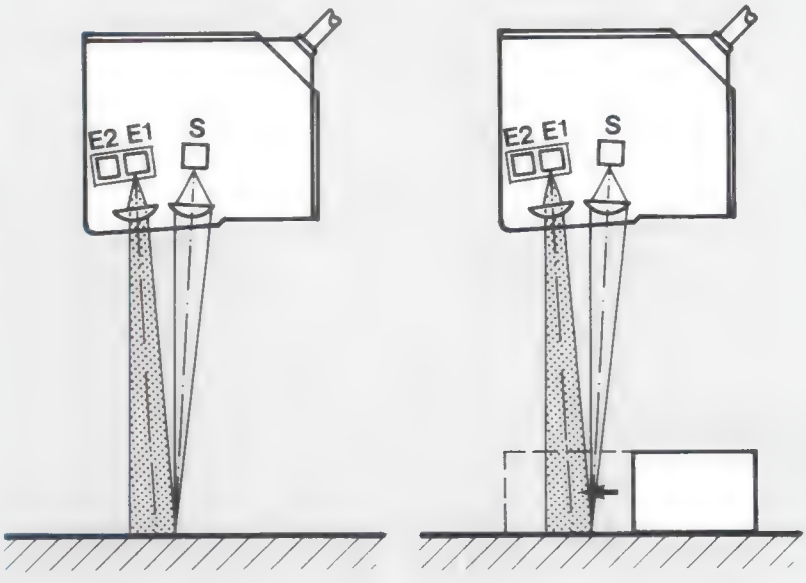


Fig. 1.
The proximity switch signals interruption of the light beam by an object

Background Suppression on Photoelectric Proximity Switches

Unlike photoelectric switches, photoelectric proximity switches signal the presence of an object. The object reflects the beam, instead of interrupting it as it does in the case of a photoelectric switch. The reflecting property of the surface of the object ought to play a subsidiary role. The proximity switch should be capable of detecting a dark object, such as black paper, as well as it does a bright object, such as white paper.

In simple systems ("energetic" proximity switches), the scanning distance is a function of the reflectance of the material being scanned and of the sensitivity of the system. In this case, a dark object implies a short scanning distance; a light object a long scanning distance. With "energetically working" proximity switches it is consequently difficult for a standard proximity switch to detect dark objects properly against a light background. Using a proximity switch equipped with background suppression, on the other hand, it is possible to differentiate reliably between an object being detected and a light background, with an extremely short gap between them.

In their proximity switches equipped with background suppression, SICK combine Opto-electronics with Mechanics (Fig. 1). The light source transmits a beam via an optic. Any object present returns a proportion of the light, depending on its reflecting capacity. The reflected light strikes light receiver E 1 via an optical system. A second receiver E 2 receives a certain proportion of light from the background surface which is at a greater distance than the object. If the proportion of light received by light receiver E 1 is greater than that at E 2, the proximity switch signals the presence of an object in the scanning distance. If the reverse situation is observed, the proximity switch signals the absence of an object. By virtue of this differential procedure, photoelectric proximity switches with background suppression work largely independently of the reflective properties of objects and background surfaces (Fig. 2).

On the WT 18, WT 27, WT 36, WT 45 and WT 12 the scanning distance can be adjusted using a pivoting mirror (Fig. 1 – symbolic). Fig. 3 shows the function of background suppression on proximity switch WT 27. In this case, even an object with only 6 % reflectance can be reliably detected in front of a light background.

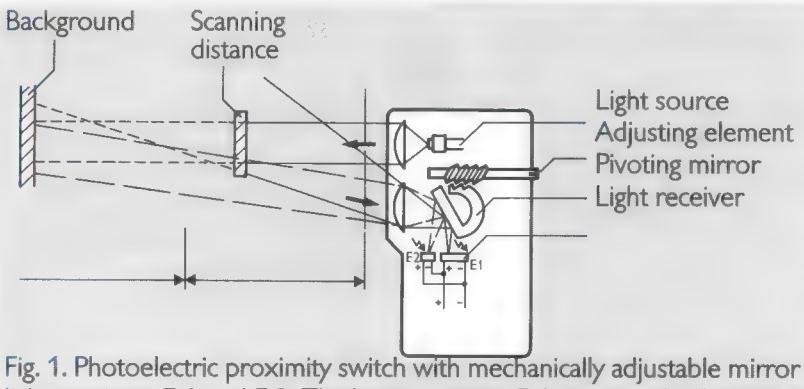


Fig. 1. Photoelectric proximity switch with mechanically adjustable mirror and light receivers E 1 und E 2. The larger receiver E 1 receives the "useful" light from the material being scanned, while E 2 receives the light from the more distant background.

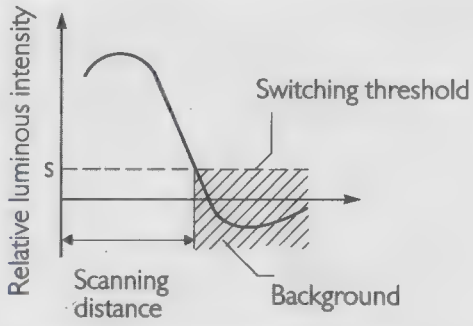


Fig. 2. The reception diagram shows the steepness of the curve caused by the difference formation between the output voltages of E 1 and E 2, and the resultant background suppression.

A = scanning range
B = background suppression range
C = background

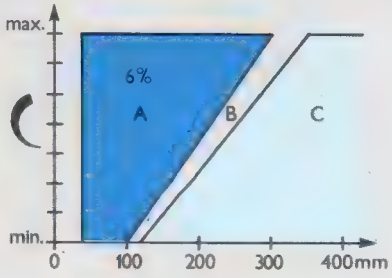


Fig. 3. Background suppression with photoelectric proximity switch WT 27. The case represented is an extreme case: a very dark object (6 % reflectance) in front of a light background.

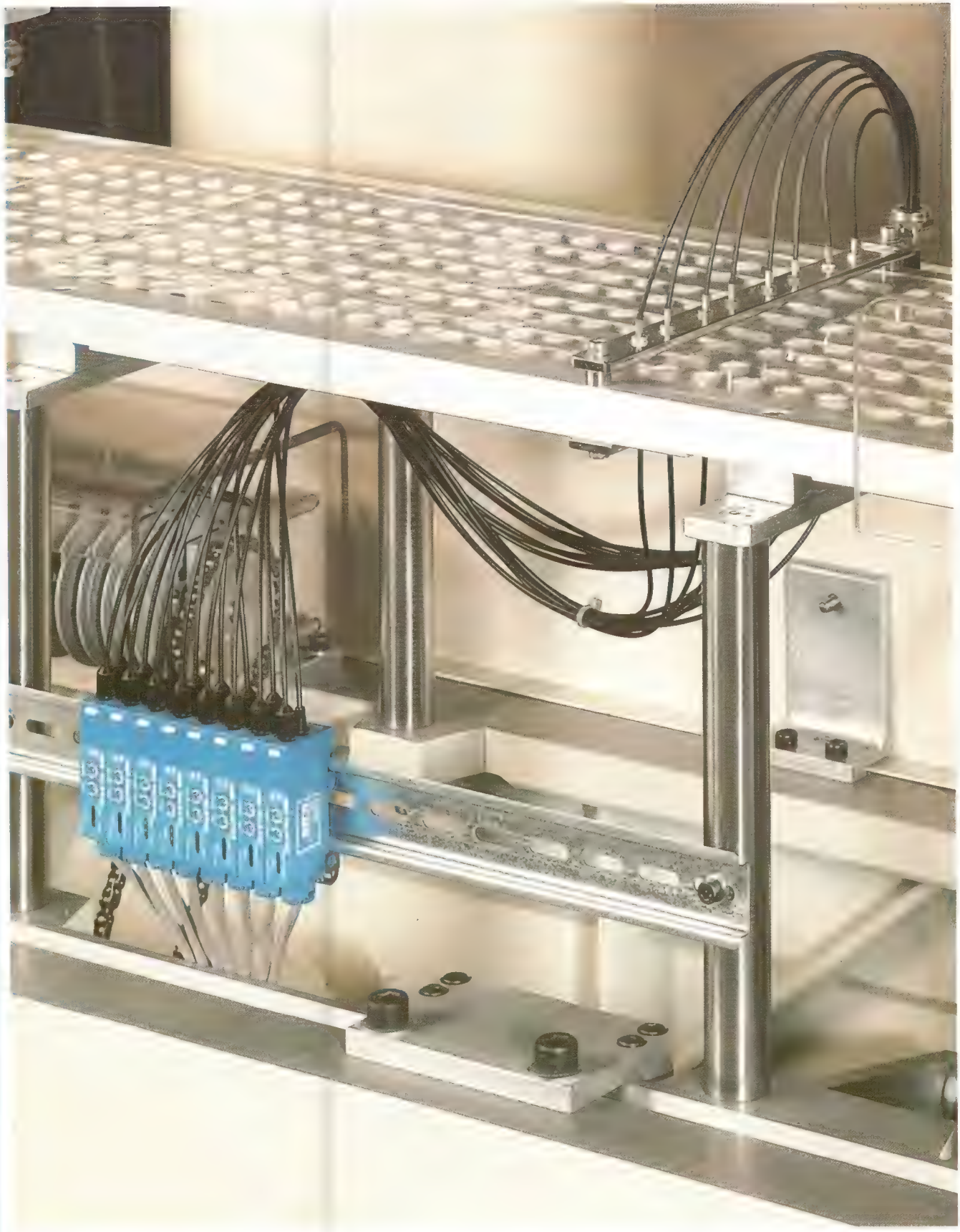
 A NT 6 monitors the position, a WT 18 controls the caps and a WL 9 generates the clock-pulse

Through-beam Photoelectric Switches

Photoelectric Reflex Switches

Photoelectric Proximity Switches

Photoelectric Fiber-optic Switches

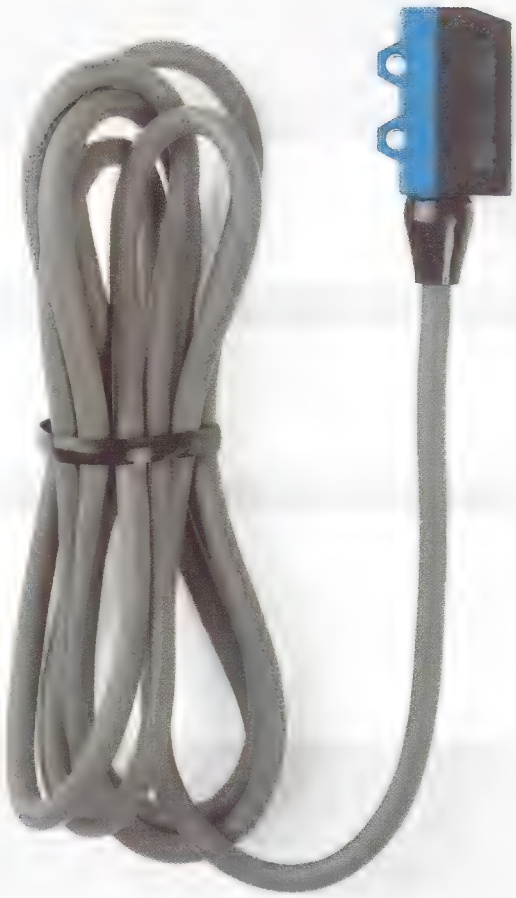


W 5-Series
Sub-miniature Photoelectric Switches

WS 5/WE 5

WT 5

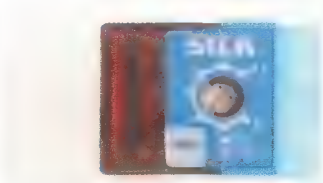
WLL 5



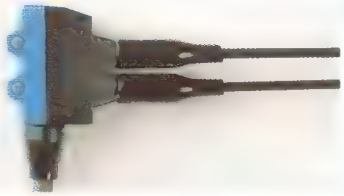
Sub-miniature photoelectric switches in plastic enclosures for restricted space applications.

Common features:
Sensitivity adjustment; LED signal strength indicator to show the switching output status or misalignment of the unit; supply voltage range from 12 to 24 VDC reverse- polarity protected; output current max. 100 mA; LIGHT- and DARK-switching; enclosure rating IP 65 (dusttight, waterproof); shock resistant to 50 g.

A complete range of sub-miniature photoelectric switches with a max. volume of 5 cm^3 in through-beam, proximity, and fiber-optic models.



Adjustable sensitivity to meet harsh operating environments.



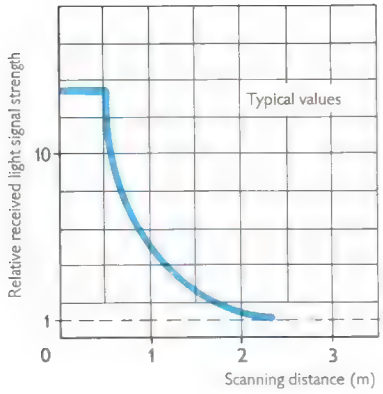
Fiber-optic models available (WLL 5) for locating the unit away from the scanning point.

Scanning Distance

1500 mm

Features

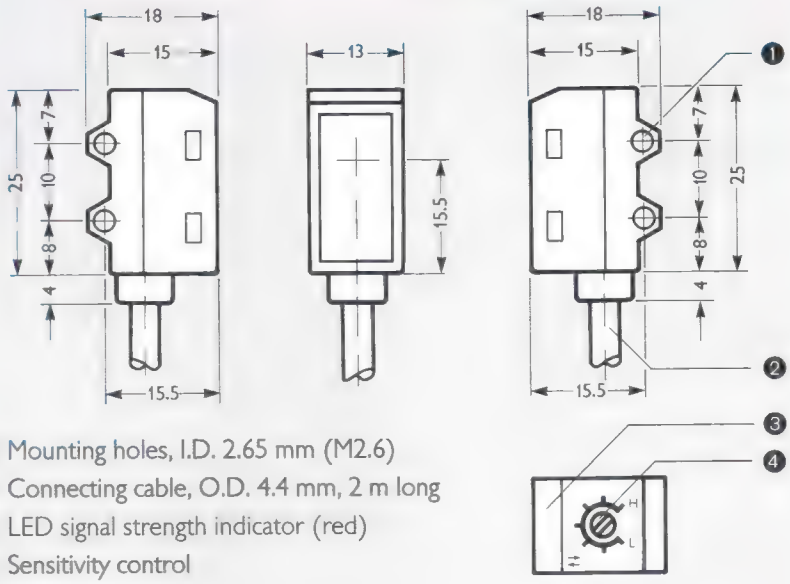
- Sub-miniature photoelectric switch
- LED signal strength indicator (red) to show misalignment
- Supply connections reverse-polarity protected
- LIGHT- and DARK-switching
- Sensitivity adjustment
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



WS/WE 5

Dimensions in mm

WS 5 Sender **WE 5 Receiver**



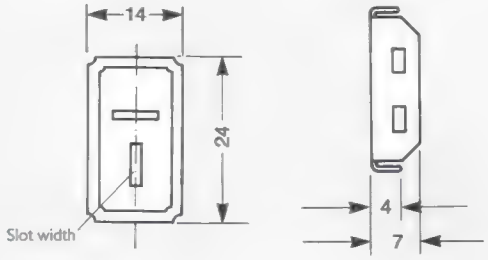
1. Mounting holes, I.D. 2.65 mm (M2.6)
2. Connecting cable, O.D. 4.4 mm, 2 m long
3. LED signal strength indicator (red)
4. Sensitivity control

For mounting bracket (included), see page 20.

Slotted masks (see accessories) are available to detect small objects or to increase the operating precision.

The slotted mask should be mounted so that the top slot is perpendicular to the travelling direction of the object to be detected.

Dimensions in mm



Slotted mask	Slotted mask placement	Scanning width	Scanning distance
None	–	7 mm	1.5 m
BL 520 2 mm slot Part No. 5304595*	on sender and receiver	2 mm	0.75 m
BL 510 1 mm slot Part No. 5304594*	on sender and receiver	1 mm	0.35 m
BL 505 0.5 mm slot Part No. 5304593*	on sender and receiver	0.5 mm	0.17 m

* Package contains two slotted masks

WS 5 / WE 5
Through-beam Photoelectric Switch

Type WS/WE 5	WS 5 Sender -D 111	WE 5 Receiver -N 132	-P 132
Part No.	1)	6 007 412[1])	6 007 411[1])
Scanning distance	1.5 m		
Supply voltage V_S	12 to 24 VDC (±10%)		
Current consumption max.	30 mA		
Ripple max.[2])	20%		
Light source	LED (infrared)	–	
Light receiver	–	LIGHT- and DARK-switching	
Sensitivity	–	adjustable	
Signal strength indicator	–	LED (red)	
Switching outputs Q and $\overline{Q}$	–	NPN	PNP
Output voltage max.	–	30 VDC	
Output current max.	–	100 mA	
Response time; switching frequency[3])	–	max. 0.7 ms; max. 700 /s	
Enclosure rating	IP 65		
Circuit protection	supply connections reverse-polarity protected		
Ambient temperature	–25 to +55 °C		
Connecting cable (oiltight)	2 x 0.2 mm²; 2 m long	5 x 0.2 mm²; 2 m long	
Weight	100 g		
Accessories (included)	2 metal mounting brackets		
	1 screwdriver		
	4 screws M2.6 with washers, nuts		
	1 connector (to connect the black wires)		

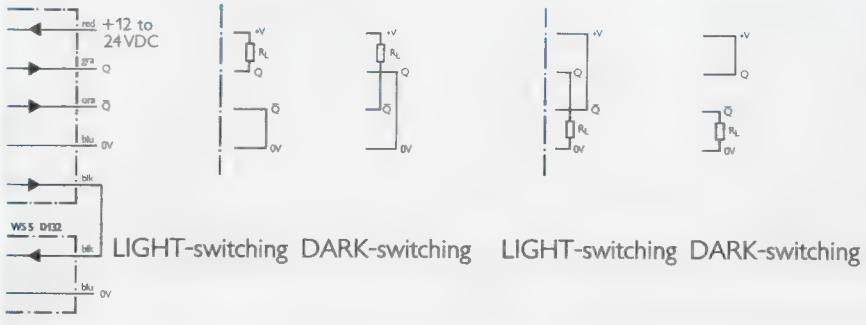
1) Part No. includes sender and receiver
2) Must not exceed max. supply voltage
3) With light/dark time ratio of 1:1

Truth Table for WE 5

Switching mode	LIGHT-switching (Q)		DARK-switching ($\overline{Q}$)	
Light received	yes	no	yes	no
Signal strength indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram

WE 5 **-N132** **-P132**



Caution:
If you don't use the NPN output, be sure to connect the wire to 0 V (never to +V).
If you don't use the PNP output, be sure to connect the wire to +V (never to 0 V).
For synchronization connect the black wire of the receiver to the black wire of the sender using the connector provided.

red	gra	ora	blu	blk
red	gray	orange	blue	black
+V	Q	$\overline{Q}$	0V	synchron-ization cable

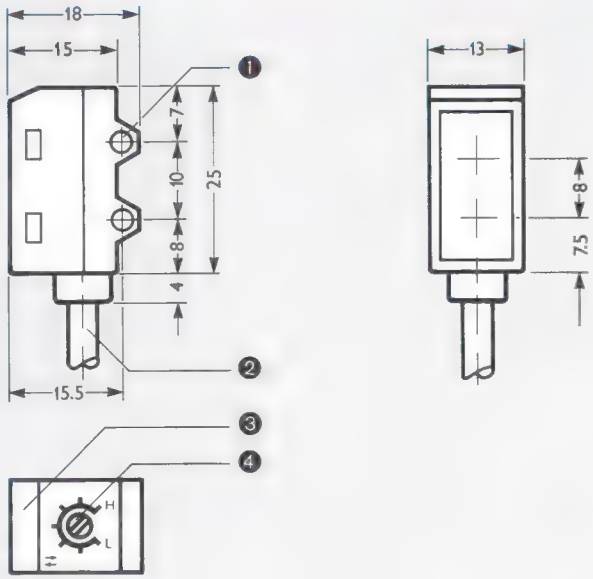
Scanning Distance

Features

- Sub-miniature photoelectric switch
- LED signal strength indicator (red) to show misalignment
- Supply connections reverse-polarity protected
- LIGHT- and DARK-switching
- Sensitivity adjustment
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing

WT 5

Dimensions in mm



❶ Mounting holes, I.D. 2.65 mm (M2.6)
❷ Connecting cable O.D. 4.4 mm, 2 m long
❸ LED signal strength indicator (red)
❹ Sensitivity control

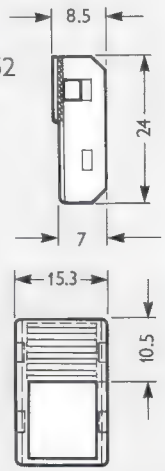
For mounting bracket (included), see page 38.

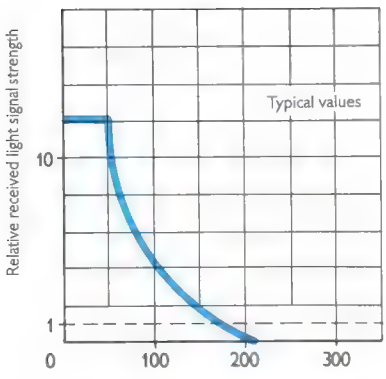
Accessories

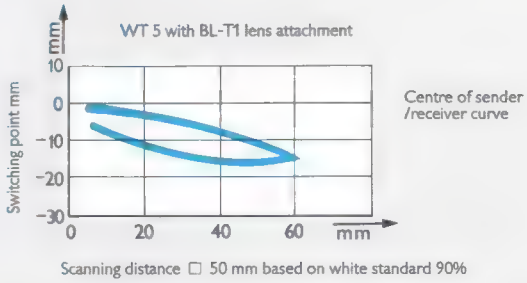
Scanning principle: Energetic, V system

Application:
- Increased sensitivity with reduced scanning distance
  White standard 90%-t_w 55 mm
  Grey Kodak 18%-t_w 40 mm
- Suppression of irritating background reflexes with reduced scanning distance

BL-T1 Lens attachment; order nr. 5304 652







Photoelectric Proximity Switch

WT 5	-N 112	-P 112
Part No.	6007164	6007165
Scanning distance	100 mm (based on paper, white standard, to DIN 5033)	
Supply voltage V_S	12 to 24 VDC (±10%)	
Current consumption max.	30 mA	
Ripple max.[1])	20%	
Light source	LED (infrared)	
Light receiver	LIGHT- and DARK-switching	
Sensitivity	adjustable	
Signal strength indicator	LED (red)	
Switching outputs Q and $\overline{Q}$	NPN	PNP
Output voltage max.	30 VDC	
Output current max.	100 mA	
Response time; switching frequency[2])	max. 0.7 ms; max. 700 /s	
Enclosure rating	IP 65	
Circuit protection	supply connections reverse-polarity protected	
Ambient temperature	−25 to +55 °C	
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long	
Weight	100 g	

1) Must not exceed max. supply voltage

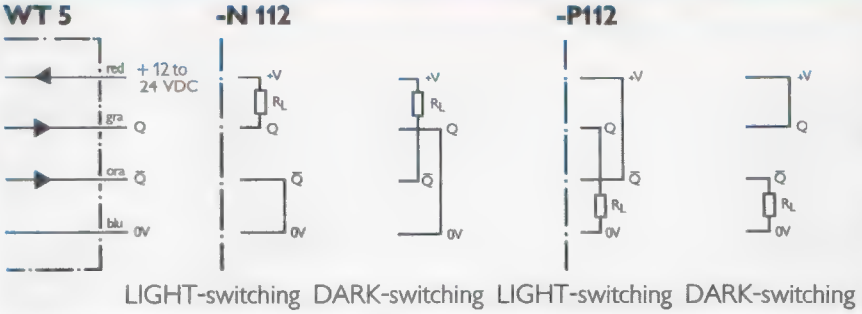
2) With light/dark time ratio of 1:1

Accessories (included)	1 metal mounting bracket
	1 screwdriver
	2 screws M2.6 with washers, nuts

Truth Table WT 5

Switching mode	LIGHT-switching (Q)		DARK-switching ($\overline{Q}$)	
Light received	yes	no	yes	no
Signal strength indicator	⩾⊗⩽	⊗	⩾⊗⩽	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram



If you don't use the NPN output, be sure to connect the wire to 0 V (never to +V).
If you don't use the PNP output, be sure to connect the wire to +V (never to 0 V)

red	gra	ora	blu
red	gray	orange	blue
+V	Q	$\overline{Q}$	0V

Scanning Distance

40 mm

For through-beam/applications

Scanning Distance

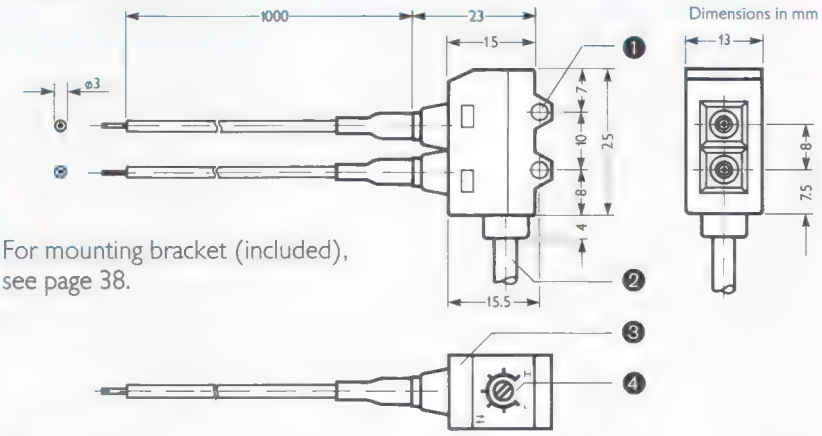
10 mm

For proximity applications

Features

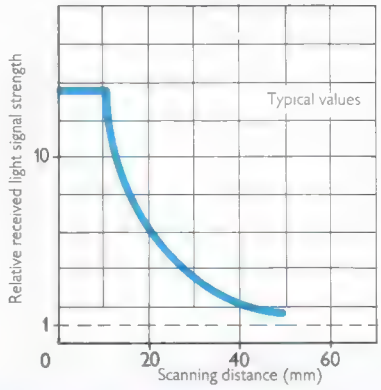
- Sub-miniature photoelectric switch
- Fiber-optic cables in 1 or 2 tip configurations
- LED signal strength indicator (red) to show misalignment
- Supply connections reverse-polarity protected
- LIGHT- and DARK-switching
- Sensitivity adjustment
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing

WLL 5-N1222/P1222
(2 tip configuration, for through-beam applications)



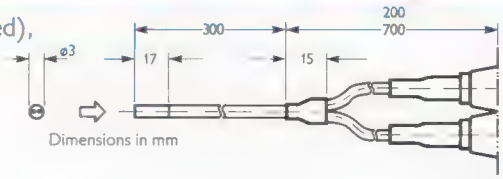
For mounting bracket (included), see page 38.

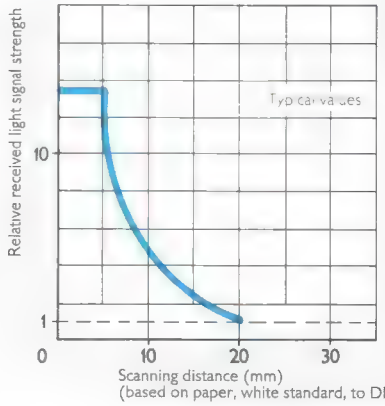
1. Mounting holes, I.D. 2.65 mm (M2.6)
2. Connecting cable, O.D. 4.4 mm, 2 m long
3. LED signal strength indicator (red)
4. Sensitivity control



WLL 5-N1112/P1112, WLL 5-N1122/P1122
(1 tip configuration, for proximity applications)

For mounting bracket (included), see page 38.





WLL 5
Photoelectric Fiber-optic Switch

WLL 5	-N 1222	-N 1112	-N1122	-P 1222	-P 1112	-P 1122
With non-detachable fiber-optic cables						
Part No.	6007167	6007166	6007168	6007170	6007169	6007171
Length of the fiber-optic cable	1 m[1])	0.5 m	1 m	1 m[1])	0.5 m	1 m
Bending radius min.	25 mm					
Scanning distance	40 mm	10 mm[2])		40 mm	10 mm[2])	
Supply voltage V_S	12 to 24 VDC (±10%)					
Current consumption max.	30 mA					
Ripple max.[3])	20%					
Light source	LED (red)					
Light receiver	LIGHT- and DARK-switching					
Sensitivity	adjustable					
Signal strength indicator	LED (red)					
Switching outputs Q and $\overline{Q}$	NPN			PNP		
Output voltage max.	30 VDC					
Output current max.	100 mA					
Response time; switching frequency[4])	max. 0.7 ms; max. 700 /s					
Enclosure rating	IP 65					
Circuit protection	supply connections reverse-polarity protected					
Ambient temperature	–25 to +55 °C					
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long					
Weight	100 g					
Accessories (included)	1 metal mounting bracket					
	1 screwdriver					
	2 screws M2.6 with washers, nuts					
WLL 5-N/P 1222 only	2 snap-in fittings to connect the fiber-optic cables					
	1 cable cutter (Part No. 5304141)					

1) Using the cable cutter provided, you can cut the fiber-optic cable to the length you need

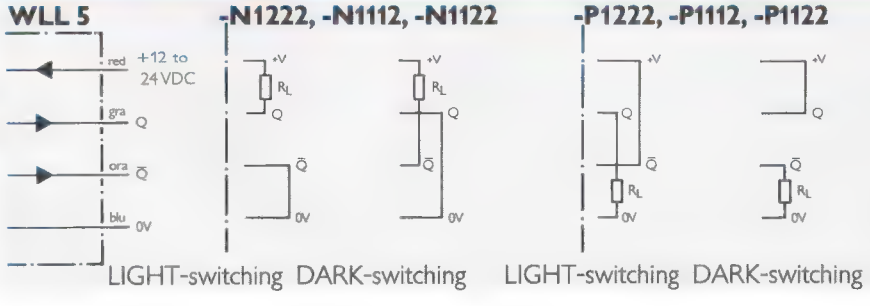
2) Based on paper, white standard, to DIN 5033
3) Must not exceed max. supply voltage

4) With light/dark time ratio of 1:1

Truth Table

Switching mode	LIGHT-switching (Q)		DARK-switching ($\overline{Q}$)	
Light received	yes	no	yes	no
Signal strength indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

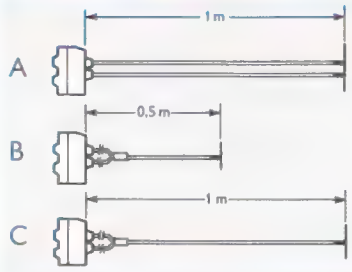
Connection Diagram



If you don't use the NPN output, be sure to connect the wire to 0V (never to +V).
If you don't use the PNP output, be sure to connect the wire to +V (never to 0V).

red	gra	ora	blu
red	gray	orange	blue
+V	Q	$\overline{Q}$	0V

Fiber-optic Cable Configurations

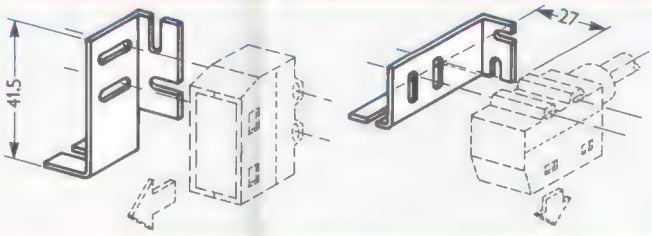


A 2 tip configuration. Using the cable cutter provided, you can cut the fiber-optic cables to the length you need.

B,C When the sender and receiver fibers are in a single tip (1 tip configuration), the fiber-optic cables cannot be shortened. Therefore, the application requirements to be met should be considered before ordering a WLL 5 model.

Mounting Bracket

(included)



Sensitivity Adjustment

The photoelectric switches are factory set to maximum sensitivity (H). If they are to detect transparent or translucent objects or if they are to be used where there is background interference, use the procedure described in the table below to adjust the sensitivity.

WS/WE 5, WLL 5-N/P 1222 Photoelectric Switches

Step	Sensitivity control	Condition to be met	Signal strength indicator	Adjustment
1		Light beam uninterrupted.	ON	-
2		Interrupt the light beam. (The signal strength indicator must go off.)	ON	Turn the control toward "L" until the red LED goes off.
3		Clear the light beam.	ON	**Adjustment is complete**
			OFF	Turn the control toward "H" until the red LED comes on.
4		If necessary, repeat steps 2 and 3.		

WT 5, WLL 5-N/P 1112, WLL 5-N/P 1122 Photoelectric Switches

Step	Sensitivity control	Condition to be met	Signal strength indicator	Adjustment
1		The object to be detected is present.	ON	-
2		The object to be detected is not present. (The signal strength ind. must go off.)	ON	Turn the control toward "L" until the red LED goes off.
3		The object to be detected is present.	ON	**Adjustment is complete**
			OFF	Turn the control toward "H" until the red LED comes on.
4		If necessary, repeat steps 2 and 3.		

Fixing the Fiber-optic Cable End

Be sure the sleeve of the fiber-optic cable is not squeezed.

General Notes

The housings and lenses of the switches are resistant to alcohol, acid, and salt, but can be dissolved by ammonia solution, or benzene. Do not use the fiber-optic cables near organic solvents, such as those used in cast resin.

Mounting Instructions

WS/WE 5 and WLL 5 (2 tip configuration): Align the units by sight and mount them temporarily. Pan the sender and receiver units in the horizontal and vertical planes back and forth across each other. Tighten the screws completely at the point halfway between where the red LEDs come on and where they go off.
WT 5 and WLL 5 (1 tip configuration): Align the unit by sight and tighten the mounting screws. Check to see that the signal strength indicator comes on when the object to be detected is present. If the LED does not come on even though the unit has been aligned properly, a sensitivity adjustment is required.

Power Supply

If a power supply unit is used, be sure to ground both the housing and the 0 V terminal.

Connecting Cable

Routing the cable along high voltage power lines may cause electrical interference. It is recommended that the connecting cable be run along a different route. When you are using 0.3 mm^2 wires, the power and output cables can be up to 100 m long.

Caution:
The black WS/WE 5 synchronization cable must not be lengthened.

W 6-Series
Miniature Photoelectric Switches

WS 6/WE 6 — 5 m

WL 6 — 2 m

WT 6 — 300 mm

WLL 6 — 150 mm

50 mm

Miniature photoelectric switches in glassfiber-reinforced plastic enclosures for restricted space applications.

Common features:

Coarse and fine sensitivity control.

LED status and signal strength indicators to show misalignment of the switch or the condition of light received (good, sufficient, insufficient, no light).

Insensitive to ambient light (sun: 30,000 lx, halogen: 10,000 lx). Response time max. 1 ms.

Supply voltage range from 12 to 24 V. Output current max. 100 mA.

Choice of LIGHT- or DARK-switching. Enclosure rating IP 66 (dusttight, waterproof).

Coarse and fine sensitivity control

A complete range of miniature photoelectric switches with a max. volume of 13 cm^3 in through-beam, proximity and fiber-optic models.

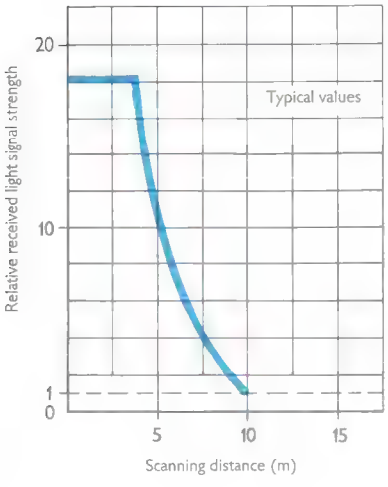
Three LED status and signal strength indicators

Scanning Distance

5 m

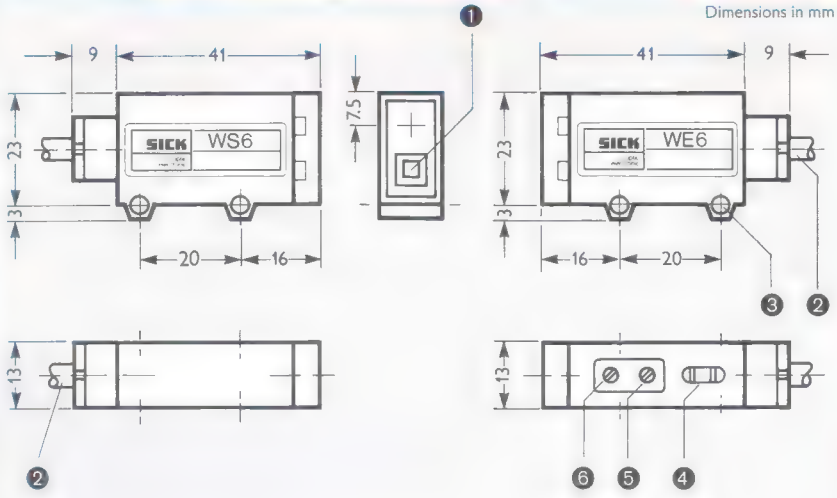
Features

- LED signal strength indicators (red, green, yellow) to show misalignment of the units
- Supply connections reverse-polarity protected
- Power indicator (on WS 6 light sender)
- Switching output short-circuit protected
- LIGHT- or DARK-switching (L/D control wire)
- Sensitivity adjustment
- No false triggering on power-up
- Insensitive to ambient light
- Glassfiber-reinforced plastic housing



WS 6 Sender / WE 6 Receiver

Dimensions in mm



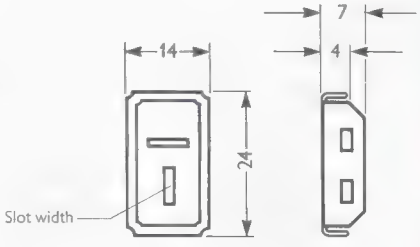
1. Power indicator (WS 6): comes on when power is switched on.
   Status indicator (WE 6): comes on when the light received is sufficient.
2. Connecting cable, O. D. 4.2 mm, 2 m long
3. Mounting holes, I. D. 3.5 mm (M3)
4. WE 6: Signal strength indicators (yellow, green, red)
5. WE 6: Fine sensitivity control
6. WE 6: Coarse sensitivity control

For mounting bracket (included), see page 51.

Slotted masks (accessories)

are available to detect small objects or to increase the operating precision.

The slotted mask should be mounted so that the top slot is perpendicular to the travelling direction of the object to be detected.



Slotted mask	Slotted mask placement	Scanning width	Scanning distance
None	–	7 mm	5 m
BL 20 2 mm slot Part No. 5304144	on sender or receiver	7 mm	3 m
	on sender and receiver	2 mm	2 m
BL 10 1 mm slot Part No. 5304143	on sender or receiver	7 mm	2 m
	on sender and receiver	1 mm	1 m
BL 05 0.5 mm slot Part No. 5304142	on sender or receiver	7 mm	1.5 m
	on sender and receiver	0.5 mm	0.5 m

WS 6/WE 6
Through-beam Photoelectric Switch

WS/WE 6	WS 6 Sender	WE 6 Receiver N 132	WE 6-P 132
Part No.	1)	6 007 356[1)]	6 007 355[1)]
Scanning distance	5 m		
Supply voltage V_S	12 to 24 VDC (±20%)		
Current consumption max.	40 mA		
Ripple max.[2)]	5 V_{pp}		
Light source	LED (infrared)	–	
Light receiver	–	LIGHT- or DARK-switching (L/D control wire)	
Sensitivity	–	adjustable (fine/coarse control)	
Signal strength indicators	–	LEDs (yellow, red, green)	
Switching output	–	NPN	PNP
Output voltage max.	–	30 VDC	
Output current max.	–	100 mA	
Response time; switching frequency[3)]	–	max. 1 ms; max. 500 /s	
Enclosure rating	IP 66		
Circuit protection	supply connections reverse-polarity protected; output short-circuit protected		
Ambient temperature	–25 to +55 °C		
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long		
Weight	100 g		

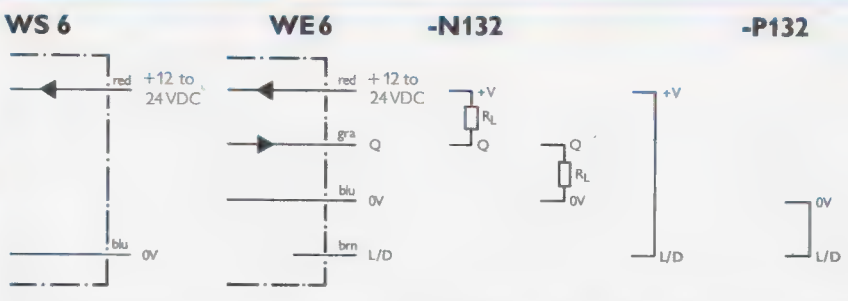
1) Part No. includes sender and receiver
2) Must not exceed max. supply voltage
3) With light/dark time ratio of 1:1

Accessories (included)	2 metal mounting brackets, 1 screwdriver, 4 screws M3 with washers, nuts
(available)	2 slotted masks BL 20 (2 mm slot), Part No. 5 304 144, see page 40
	2 slotted masks BL 10 (1 mm slot), Part No. 5 304 143, see page 40
	2 slotted masks BL 05 (0.5 mm slot), Part No. 5 304 142, see page 40

Truth Table

Switching mode	LIGHT-switching		DARK-switching	
Light received	yes	no	yes	no
'LIGHT' indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram



Note: Switch should not be operated unless the control wire (brown) is connected to +V or 0 V.

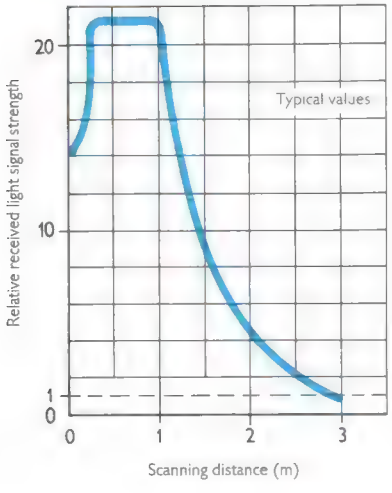
red	gra	blu	brn
red	grey	blue	brown
+V	Q	0V	L/D

Scanning Distance

2 m

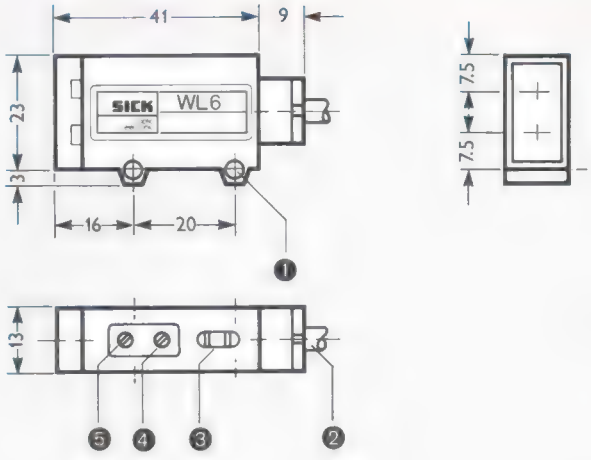
Features

- LED signal strength indicators (red, green, yellow) to show misalignment of the unit
- Supply connections reverse-polarity protected
- Switching output short-circuit protected
- LIGHT- or DARK-switching (L/D control wire)
- Sensitivity adjustment
- No false triggering on power-up
- Insensitive to ambient light
- Glassfiber-reinforced plastic housing



WL 6

Dimensions in mm

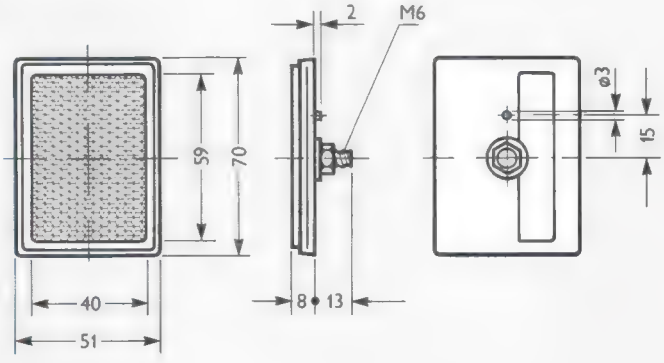


1. Mounting holes, I.D. 3.5 mm (M3)
2. Connecting cable, O.D. 4.2 mm, 2 m long
3. LED signal strength indicators (yellow, green, red)
4. Fine sensitivity control
5. Coarse sensitivity control

For mounting bracket (included), see page 51.

Reflector PL 72 (included), Part No. 5304145

PL 72



WL 6
Photoelectric Reflex Switch

WL 6	-N 172	-P 172
Part No.	6 007 024	6 007 025
Scanning range		
With PL 72 reflector	0.1 to 2 m	
Supply voltage V_S	12 to 24 VDC (±20%)	
Current consumption max.	40 mA	
Ripple max.[1])	5 V_{pp}	
Light source	LED (infrared)	
Light receiver	LIGHT- or DARK-switching (L/D control wire)	
Sensitivity	adjustable (fine/coarse control)	
Signal strength indicators	LEDs (yellow, green, red)	
Switching output	NPN	PNP
Output voltage max.	30 VDC	
Output current max.	100 mA	
Response time; switching frequency[2])	max. 0,7 ms; max. 700 /s	
Enclosure rating	IP 66	
Circuit protection	supply connections reverse-polarity protected; output short-circuit protected	
Ambient temperature	−25 to +55 °C	
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long	
Weight	100 g	

1) Must not exceed max. supply voltage
2) With light/dark time ratio of 1:1

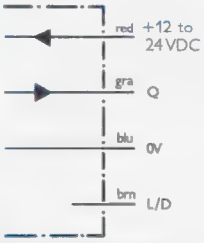
Accessories (included): 1 reflector PL 72, 1 metal mounting bracket, 1 screwdriver, 2 screws M3 with washers, nuts

Truth Table

Switching mode	LIGHT-switching		DARK-switching	
Light received	yes	no	yes	no
'LIGHT' indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram

WL 6



L/D = control wire

-N 172

-P 172

LIGHT-switching

DARK-switching

Note:
Switch should not be operated unless the control wire (brown) is connected to +V or 0 V.

red	gra	blu	brn
red	grey	blue	brown
+V	Q	0V	L/D

Scanning Distance

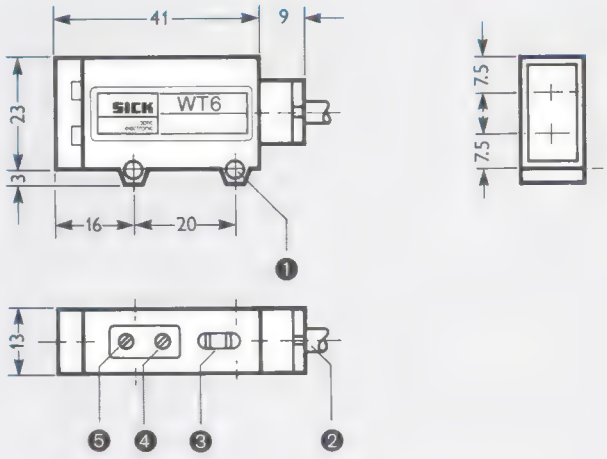
300 mm

Features

- LED signal strength indicators (red, green, yellow) to show misalignment of the unit
- Supply connections reverse-polarity protected
- Built-in switching amplifier
- LIGHT- or DARK-switching (L/D control wire)
- Sensitivity adjustment
- Insensitive to ambient light
- Glassfiber-reinforced plastic housing

WT 6

Dimensions in mm



1. Mounting holes, I.D. 3.5 mm (M3)
2. Connecting cable, O.D. 4.2 mm, 2 m long
3. LED signal strength indicators (yellow, green, red)
4. Fine sensitivity control
5. Coarse sensitivity control

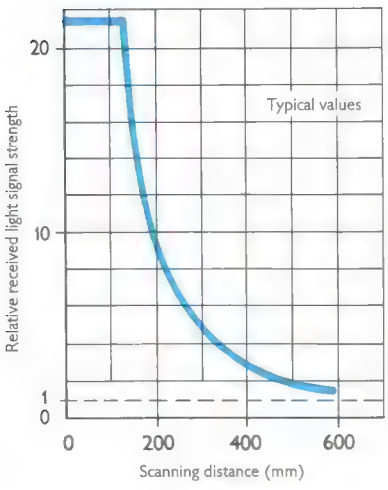
For mounting bracket (included), see page 51.

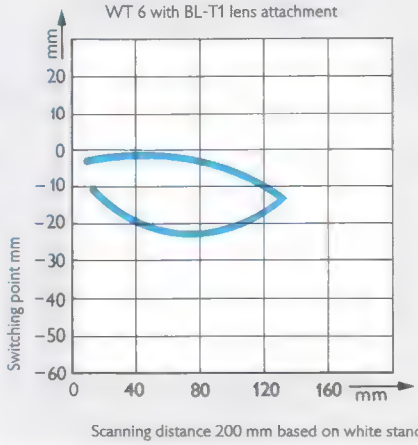
Accessories

Scanning principle: Energetic, V system

Application:

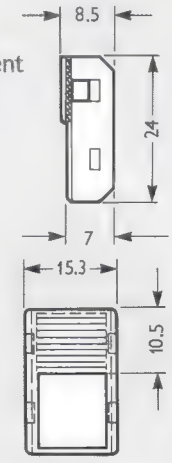
– Increased sensitivity with reduced scanning distance
White standard 90%-t_w 90 mm
Grey kodak 18%-t_w 65 mm
Suppression of irritating background reflexes with reduced scanning distance





BL-T1 lens attachment
order nr. 5304652

Centre of sender/
receiver curve



WT 6
Photoelectric Proximity Switch

WT 6	-N 132	-P 132
Part No.	6007026	6007027
Scanning distance	300 mm[1])	
Supply voltage V_S	12 to 24 VDC (±20%)	
Current consumption max.	40 mA	
Ripple max.[2])	5 V_{pp}	
Light source	LED (infrared)	
Light receiver	LIGHT- or DARK-switching (L/D control wire)	
Sensitivity	adjustable (coarse/fine control)	
Signal strength indicators	LEDs (yellow, red, green)	
Switching output	NPN	PNP
Output voltage max.	30 VDC	
Output current max.	100 mA	
Response time; switching frequency[3])	max. 0.7 ms; max. 700 /s	
Enclosure rating	IP 66	
Circuit protection	supply connections reverse-polarity protected	
Ambient temperature	−25 to +55 °C	
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long	
Weight	100 g	

1) Based on paper, white standard, 200 x 200 mm²
2) Must not exceed max. supply voltage
3) With light/dark time ratio of 1:1

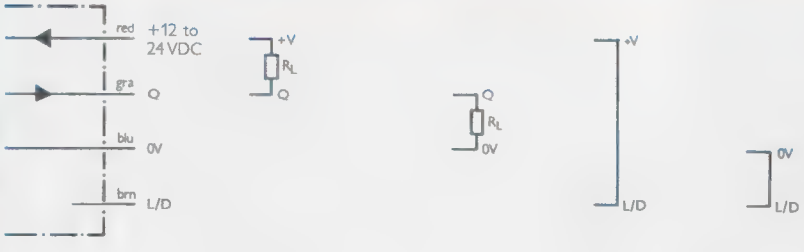
Accessories (included): 1 metal mounting bracket, 1 screwdriver, 2 screws M3 with washers, nuts

Truth Table

Switching mode	LIGHT-switching		DARK-switching	
Light received	yes	no	yes	no
'LIGHT' indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram

WT 6 **-N 132** **-P 132**



L/D = control wire

LIGHT-switching DARK-switching

Note:
Switch should not be operated unless the control wire (brown) is connected to +V or 0 V.

red	gra	blu	brn
red	grey	blue	brown
+V	Q	0V	L/D

Scanning Distance

150 mm max.

For through-beam applications

Scanning Distance

50 mm max.

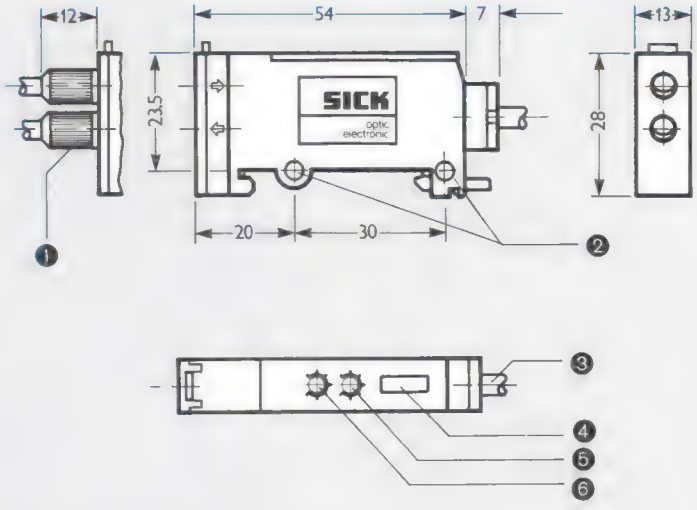
For proximity applications

Features

- Interchangeable fiber-optic cables in 1 or 2 tip configurations
- Various fiber-optic cable types and lengths available
- LED signal strength indicators (red, green, yellow) to show misalignment of the unit
- Supply connections reverse-polarity protected
- Switching output short circuit protected
- LIGHT- or DARK-switching (L/D control wire)
- Sensitivity adjustment
- No false triggering on power-up
- Insensitive to ambient light
- Glassfiber-reinforced plastic housing
- DIN track mounting

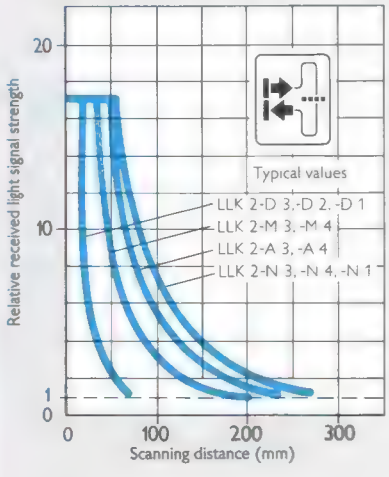
WLL 6

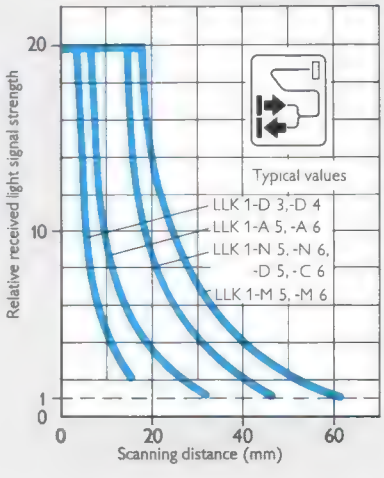
Dimensions in mm



1. Fiber-optic cable connector
2. Mounting holes, I.D. 3.5 mm (M3)
3. Connecting cable, O.D. 4.2 mm, 2 m long
4. LED signal strength indicators (yellow, green, red)
5. Fine sensitivity control
6. Coarse sensitivity control

For mounting bracket (included), see page 51.
For fiber-optic cables (accessories), see page 48.





Photoelectric Fiber-optic Switch

WLL 6	-N 112	-P 112	-N 122	-P 122
With interchangeable fiber-optic cables				
Part No.	6007031	6007032	6007033	6007034
Scanning distance	see page 46 and 48			
Supply voltage V_S	12 to 24 VDC (±20%)			
Current consumption max.	50 mA			
Ripple max.[1])	5 V_{pp}			
Light source	LED (infrared)		LED (red)	
Light receiver	LIGHT- or DARK-switching (L/D control wire)			
Sensitivity	adjustable (coarse/fine control)			
Signal strength indicators	LEDs (yellow, red, green)			
Switching output	NPN	PNP	NPN	PNP
Output voltage max.	30 VDC			
Output current max.	100 mA			
Response time; switching frequency[2])	max. 0.7 ms; max. 700 /s			
Enclosure rating	IP 66			
Circuit protection	supply connections reverse-polarity protected; output short circuit protected			
Ambient temperature	−25 to +50°C			
Connecting cable (oiltight)	4 x 0.2 mm², 2 m long			
Weight	100 g			

1) Must not exceed max. supply voltage
2) With light/dark time ratio of 1:1

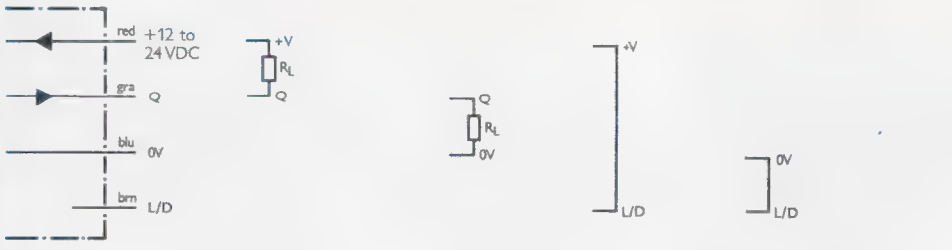
Accessories (included): 1 metal mounting bracket, 1 screwdriver, 2 screws M3 with washers, nuts

Truth Table

Switching mode	LIGHT-switching		DARK-switching	
Light received	yes	no	yes	no
'LIGHT' indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
NPN output	LOW	HIGH	HIGH	LOW
PNP output	HIGH	LOW	LOW	HIGH

Connection Diagram

WLL 6 **-N 112, -N 122** **-P 112, -P 122**



L/D = control wire

LIGHT-switching DARK-switching

Note: Switch should not be operated unless the control wire (brown) is connected to +V or 0 V.

red	gra	blu	brn
red	grey	blue	brown
+V	Q	0V	L/D

Selection Table of Fiber-optic Cables for WLL 6

Sender and receiver fibers in separate tips for through-beam applications

Model	LLK2-N3	LLK2-N4	LLK2-N1	LLK2-A3	LLK2-A4	LLK2-D3	LLK2-D1	LLK2-D2	LLK2-M3	LLK2-M4	LLK2-M7
Part No.	**5304146**	**5304147**	5304148	**5304149**	**5304150**	5304151	5304152	5304153	**5304154**	**5304155**	5304156
Type	M4 Standard, Special tip adapters available	M4 Standard	M3 Standard	M4 Coiled, Special tip adapters available	M4 Coiled	M4 Fine, Special tip adapters available	M3 Fine	M3 Fine	M4 Multiple, Special tip adapters available	M4 Multiple	Multiple fibers, all in a line
Light spot	Ø 1 mm					Ø 0.5 mm			Ø 0.25 mm[1])		0.25 mm[1])
Scanning distance[1])	150 mm [30 mm]			120 mm		50 mm [10 mm]			100 mm [20 mm]		
Armor / core	PE / PMMA										
Ambient temperature	–25 to +60°C										
Minimum bending radius	25 mm					15 mm			7.5 mm		
Cable length	2 m										
Accessories[2])	cable cutter, adapters										
Features and advantages	Long scanning distance (1.5 m with BF-L tip adapter)	Extended reach	Space-saving mounting; long scanning distance	Coiled cable makes it possible to mount the tips on moving parts of the machine.		Cable O.D. = 1 mm	Cable O.D. = 1 mm	Cable O.D. = 1 mm	Smallest possible bending radius		Well suited for detecting oblong marks or small objects

Selection Table of Fiber-optic Cables for WLL 6

Sender and receiver fibers in a single tip for proximity applications

Model	LLK1-N5	LLK1-N6	LLK1-A5	LLK1-A6	LLK1-D3	LLK1-D4	LLK1-C5	LLK1-C6	LLK1-M5	LLK1-M6	LLK1-M7	LLK1-C8
Part No.	**5304157**	**5304158**	**5304159**	**5304160**	5304161	5304162	**5304163**	**5304164**	**5304165**	**5304166**	5304167	5304168
Type	M6x0.75 Standard	M6x0.75 Standard	M6x0.75 Coiled	M6x0.75 Coiled	M4 Fine	M4 Fine	M4/ M6x0.75 Coaxial	M4/ M6x0.75 Coaxial	M4/ M6x0.75 Multiple fibers	M4/ M6x0.75 Multiple fibers	Multiple fibers, all in a line	Multiple fibers
Light spot	Ø 1 x 2				Ø 0.5 x 2		Ø1, Ø0.25 x 16		Ø 0.25 x 16 x 2		0.25x16x2	Ø 1, Ø0.25 x 16
Scanning distance[3])	50 mm [10 mm]		15 mm		15 mm [3 mm]		50 mm [10 mm]		30 mm [6 mm]		30 mm [6 mm]	
Armor / core	PE / PMMA											
Ambient temperature	–25 to +60°C											
Minimum bending radius	25 mm				15 mm		25 mm		7.5 mm			–
Cable length	2 m											90 mm
Accessories[2])	cable cutter, adapters											–
Features and advantages	Standard type	Extended reach	Coiled cable makes it possible to mount the tips on moving parts of the machine.		Cable O.D. = 1 mm Space-saving mounting	Cable O.D. = 1 mm Sleeve Ø1.5 mm	Well suited for positioning or detecting fine wires		Smallest possible bending radius		Well suited for detecting wide marks or moving objects	No further mounting nesessary

1) with WLL 6-.122 / 2 m long (with WLL 6-.112 / 0.5 m long)
2) included
3) with WLL 6-.122 / 2 m long (with WLL 6-.112 / 0.5 m long) based on paper, white standard, 30 x 30 mm²

Standard models are printed in **boldface**

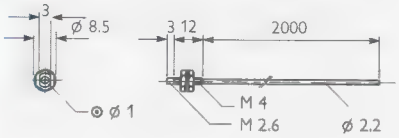
2-tip Configuration

Note: The fiber-optic cables are made up by tightening the adapter sleeves at the length required. The salient parts are cut using the cable cutter.

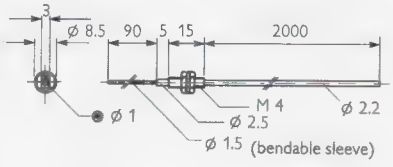
For through-beam applications

Standard types

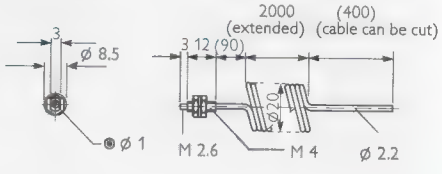
LLK2-N3 For use with tip adapters



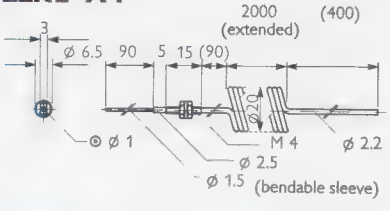
LLK2-N4



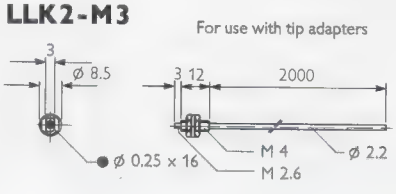
LLK2-A3 For use with tip adapters



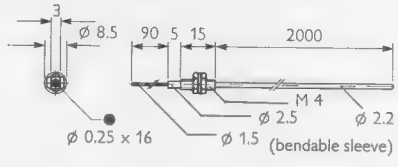
LLK2-A4



LLK2-M3 For use with tip adapters



LLK2-M4



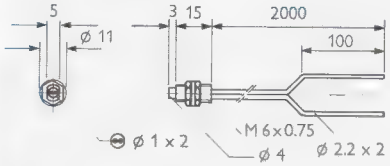
1-tip Configuration

Dimensions in mm

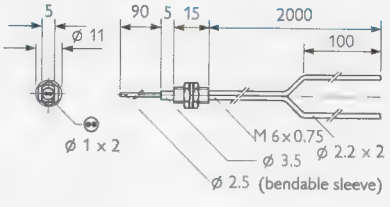
For proximity applications

Standard types

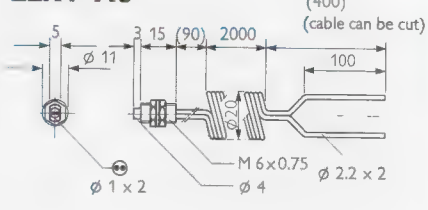
LLK1-N5



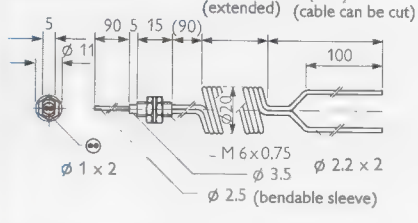
LLK1-N6



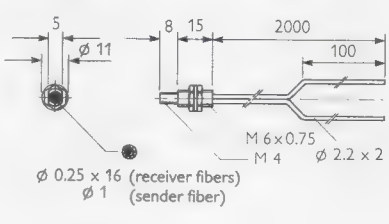
LLK1-A5



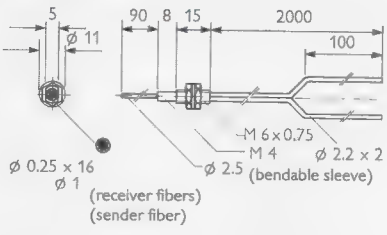
LLK1-A6



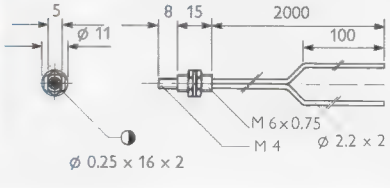
LLK1-C5



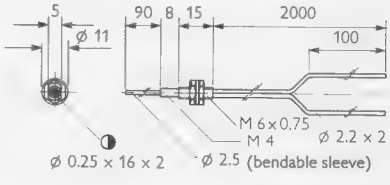
LLK1-C6



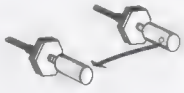
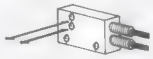
LLK1-M5



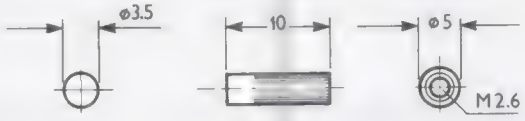
LLK1-M6



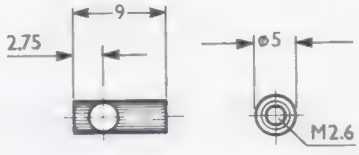
Accessories for Fiber-optic Cables

	Tip adapter	Right-angle tip adapter	Right-angle tip adapter	Angular reflection tip adapter
Model	BF-L	BF-S	BF-D	BF-R
Part No.	5 304 137	5 304 138	5 304 139	5 304 140
Type				
Features and advantages	Long scanning distances	Through beam applications; parallel installation	Reflective-type applications; space-saving mounting	Defined scanning distances; high sensitivity
For use with	LLK2-N3, LLK2-A3, LLK2-D3, LLK2-M3		LLK2-N3	
Scanning distance of WLL 6-N/P122 and LLK 2-N3	10 x	1.5 x	35 mm, based on paper, white standard, 30 x 30 mm²	10 ± 2 mm Light spot min. 1 mm

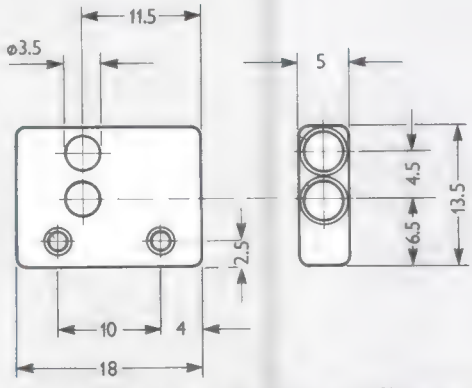
BF-L Tip adapter



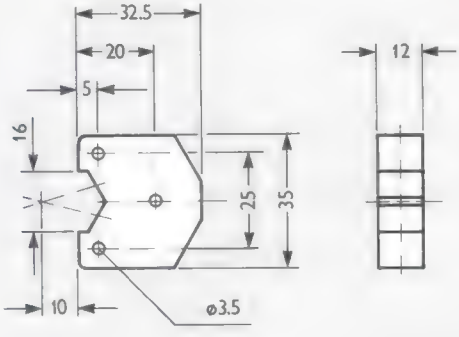
BF-S Right-angle tip adapter



BF-D Right-angle tip adapter

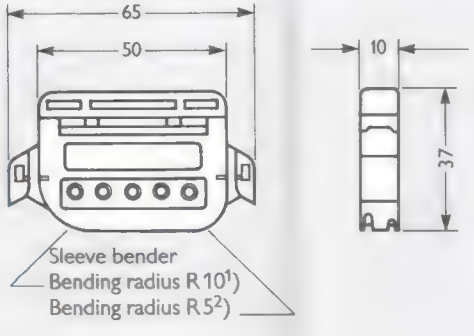


BF-R Angular reflection tip adapter



Dimensions in mm

FC Cable cutter, Part No. 5 304 141 (included with fiber-optic cables)*



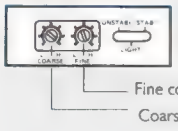
1) Sleeves Ø 2.5 mm and 1.5 mm
2) Sleeves Ø 0.9 mm

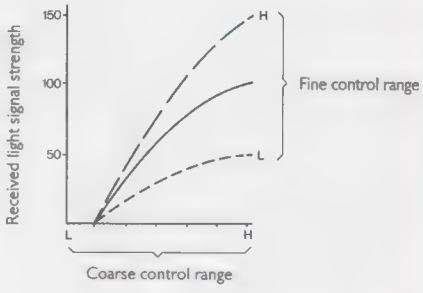
*Also refer to notes on the packaging.

Sensitivity Adjustment

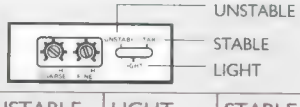
If the light received is insufficient use the procedure described in the table below to adjust the sensitivity. Be sure the following conditions are met:

- If no sensitivity adjustment is necessary, the adjusters should be set to the "H" ends of the scales.
- Use the screwdriver supplied with the unit to adjust the sensitivity. To avoid damaging the adjusters do not turn them past the ends of the scales.
- If the light incidence varies, check to see if any of the environmental conditions have changed (temperature, voltage, dirty optics, misalignment).





Sensitivity control	Condition to be met	Adjustment	Remarks
COARSE	Reflex and through-beam with an uninterrupted light beam	Turn the COARSE control toward "L" and further on to "H" until the red LED goes on. Call this point A.	If the LED does not go off, consider point A to be at "L". If the LED does not go on, check mounting instructions.
	Proximity with the object present		
COARSE	Reflex and through-beam with an interrupted light beam	Turn the coarse control toward "H" and further on to "L" until the red LED goes off. Call this point B. Set the COARSE control at the point halfway between points A and B (=point C).	If the LED does not come on, consider point B to be at "H". If the LED does not go off, consider point B to be at L. Use fine control to adjust the sensitivity.
	Proximity with the object absent		
FINE	Reflex and through-beam with an uninterrupted light beam	Turn the FINE control toward "L" and further on to "H" until the red LED goes on. Call this point A.	If the LED does not go off, consider point A to be at "L". If the LED does not come on, check mounting instructions.
	Proximity with the object present		
FINE	Reflex and through-beam with an interrupted light beam	Turn the FINE control toward "H" and further on to "L" until the red LED goes off. Call this point B. Set the fine control at the point halfway between points A and B (= point C).	If the LED does not come on, consider point B to be at "H". If the LED does not go off, check mounting instructions (possibly shield required).
	Proximity with the object absent		



Strength of received light	Condition of light received	UNSTABLE yellow	LIGHT red	STABLE green	Output LIGHT-switching	Output DARK-switching
>130%	good	OFF	ON	ON	ON	OFF
100-130%	sufficient	OFF	ON	OFF	ON	OFF
70-100%	insufficient	ON	OFF	OFF	OFF	ON
<70%	no light	OFF	OFF	OFF	OFF	ON

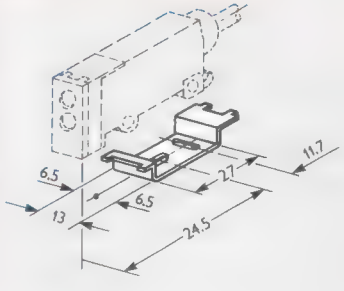
Mounting Instructions

- Align the unit by sight and mount it temporarily, that is don't tighten the screws completely.
- Pan the unit in the horizontal and vertical planes. Tighten the screws completely at the point halfway between where the red LED (LIGHT) comes on and where it goes off.
- Check to see that the red (and possibly the green) indicator comes on when the light beam is uninterrupted (through-beam and reflex), or when the object is present (proximity).
- Check to see that the yellow indicator comes on when the light beam is interrupted (through-beam and reflex), or when the object is absent (proximity).
- The best possible alignment is obtained when the green (STABLE) and red (LIGHT) indicators are on.
- With reflective objects that are difficult to detect the photoelectric proximity switch should be mounted at a 5 to 15° angle.

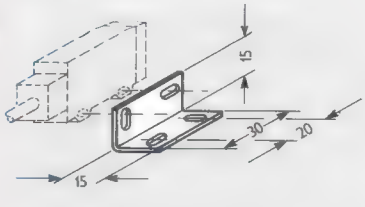
Mounting Brackets

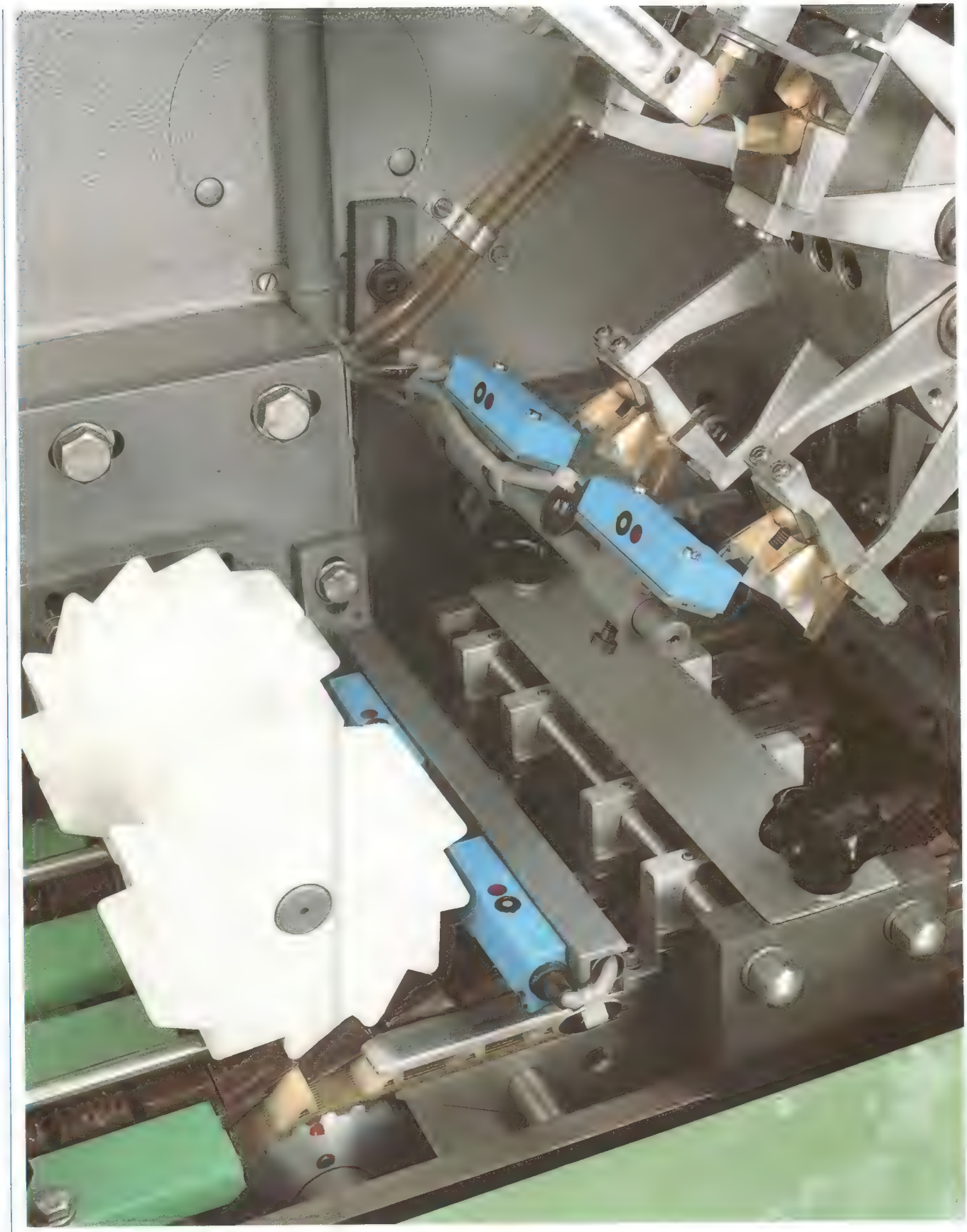
Dimensions in mm

WLL 6



WL 6, WT 6
WS 6, WE 6





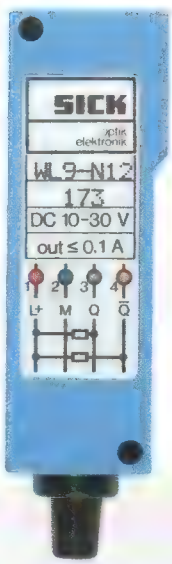
52 | WT 9 photoelectric proximity switches monitoring delivery of product and packaging material on a sweet packaging machine

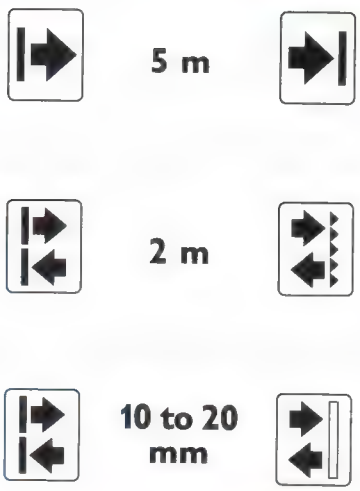
W 9-Series
Photoelectric Switches

WS 9 / WE 9

WL 9

WT 9





Slim-line switches in a glassfiber-reinforced plastic housing.

With sensitivity control and blinking signal strength indicator for monitoring dirt build-up and to show misalignment.

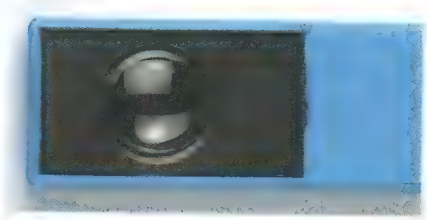
Polarizing filter with WL 9 photoelectric reflex switch.

Supply voltage from 10 to 30 V.

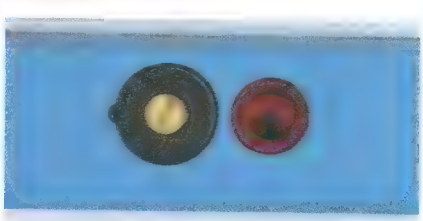
Complementary switching outputs for light-switching and dark- switching modes. Outputs short circuit protected, NPN or PNP versions available.

Insensitive to ambient light through interference suppression.

Available as through-beam photoelectric switch (with test input to test the sensor on demand from a remote location), as photoelectric reflex switch and as photoelectric proximity switch.



Behind the precision optics there is a polarizing filter, which enables objects with reflecting surfaces to be detected.



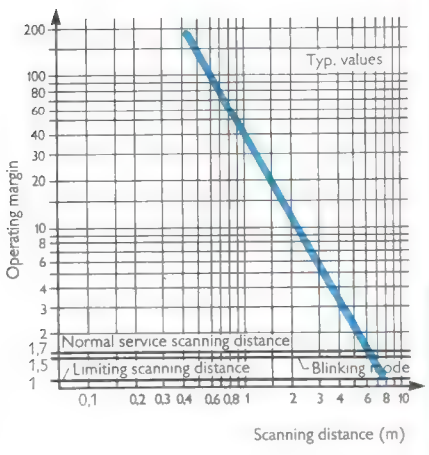
Signal strength indicator and sensitivity control

Scanning Distance

5 m

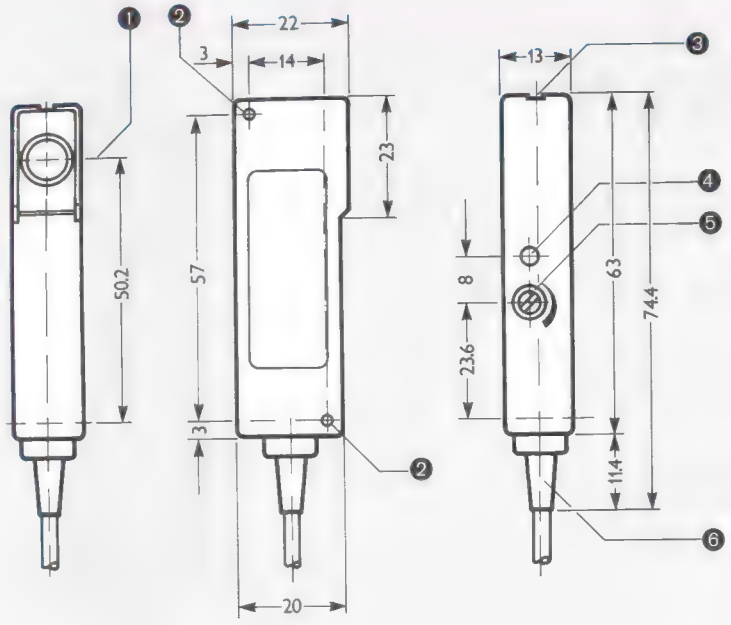
Features

- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Power indicator for light sender (WS); signal strength indicator for light receiver (WE)
- Complementary switching outputs Q and $\overline{Q}$ (light- and dark-switching)
- Switching outputs short circuit protected
- Insensitive to ambient light
- Test input to test sensor on demand from remote location
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



WS 9 / WE 9

Dimensions in mm

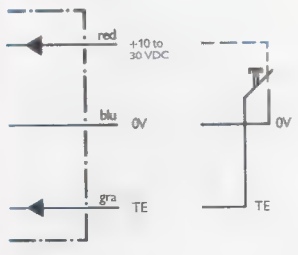


1. Centre of optical axis
2. Mounting holes, I.D. 3.2 mm
3. Alignment sight
4. Signal strength indicator on WE 9
   Power indicator on WS 9
5. Sensitivity control on WE
6. Connecting cable, 2 m long

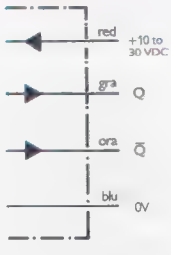
For mounting bracket (accessories), Part No. 2009120, see page 147.

Connection Diagram

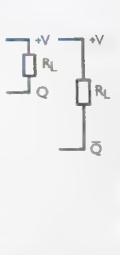
WS 9-D 132



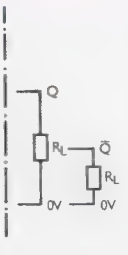
WE 9



-N 132



-P 132



red	blu	gra	ora
red	blue	gray	orange

Through-beam Photoelectric Switch

Model	WS 9 / WE 9	Light Sender WS 9-D I32	Light Receiver WE 9-N I32	WE 9-P I32
Part No.			1010904	1010905
Type of connection		cable		
Mounting bracket, Part No.		2009120		
Scanning range		0 to 5 m		
Supply voltage V_S		10 to 30 VDC (limit values)		
Current consumption (no load)		≦20 mA	≦30 mA	
Ripple[1])		≦5 V_{PP}	≦5 V_{PP}	
Indicators		LED power indicator, red	LED signal strength indicator, red	
Light source		IR LED, modulated, average service life 100,000 h[2])		
Angle of dispersion / angle of reception		approx. 3.5°		
Light spot diameter		approx. 300 mm at a distance of 5 m		
Light receiver switching mode		–	LIGHT- and DARK-switching	
Sensitivity		–	adjustable (270°-potentiometer)	
Signal strength indicator		–	LED	
Switching outputs Q and $\overline{Q}$		–	NPN	PNP
Signal voltage HIGH		–	approx. V_S	V_S – (≦1.5 V)
Signal voltage LOW[3])		–	≦1.5 V	approx. 0 V
Output current max.		–	100 mA	
Response time[4]); switching frequency[5])		–	≦200 µs; max. 2500/s	
Test input		light source disconnected	–	
Internal resistance		≧22 kΩ		
Light source ON		test input to V_S or not connected		
Light source OFF		test input to 0 V		
Enclosure rating		IP 67		
Circuit protection[6])		A, B, C		
Ambient operating temperature[7])		–25 to +55 °C		
Storage temperature [7])		–40 to +75 °C		
Connecting cable		2 m, PVC, 3 x 0.25 mm²	2 m, PVC, 4 x 0.25 mm², O.D. 5 mm	
Weight (incl. cable)		approx. 100 g	approx. 100 g	approx. 100 g

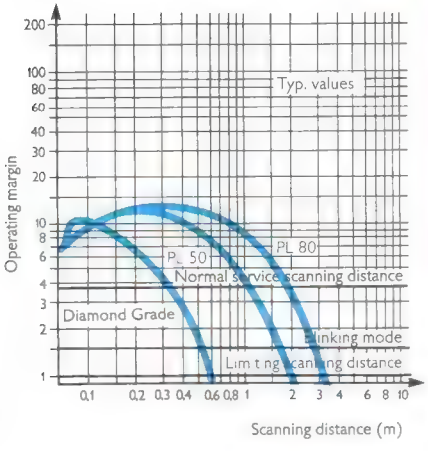
1) Must be within V_S tolerances
2) At room temperature = +25 °C
3) At room temperature = +25 °C and output current of 100 mA
4) With resistive load
5) With light/dark time ratio of 1:1
6) A = supply connections reverse-polarity protected
   B = outputs Q and $\overline{Q}$ short circuit protected
   C = interference suppression
7) Do not distort cable below 0 °C

Scanning Distance

2 m

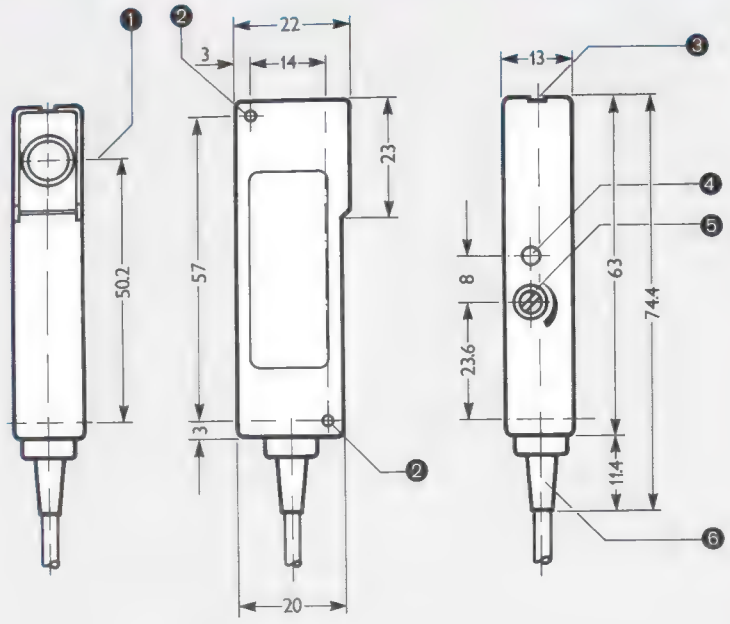
Features

- Polarizing filter, enabling objects even with reflecting surfaces to be detected
- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$ (light- and dark-switching)
- Switching outputs short circuit protected, PNP or NPN
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



WL 9

Dimensions in mm

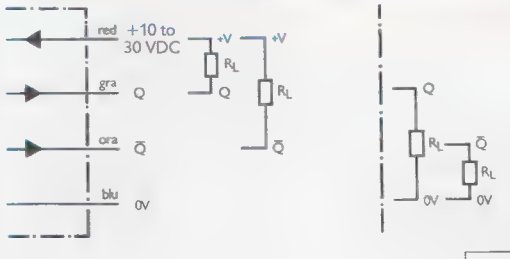


1. Centre of optical axis
2. Mounting holes, I.D. 3.2 mm
3. Alignment sight
4. Signal strength indicator
5. Sensitivity control
6. Connecting cable, 2 m long

For reflectors (accessories), see page 144.
For mounting bracket (accessories), Part No. 2009120, see page 147.

Connection Diagram

WL 9 **-N 122, -N 132 -P 122, -P 132**



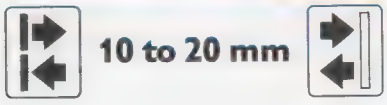
red	gra	ora	blu
red	gray	orange	blue

Photoelectric Reflex Switch

WL 9	-N I22	-P I22	-N I32	-P I32
Part No.	1006389	1006388	1005709	1005708
Type of connection	cable			
Mounting bracket, Part No.	2009120			
Scanning range				
With PL 80 reflector	Part No. 1003865	0 to 0.3 m	0 to 2.0 m	
With PL 50 reflector	Part No. 1000132	0 to 0.2 m	0 to 1.2 m	
With PL 30 reflector	Part No. 1002314	0 to 0.15 m	0 to 0.9 m	
With "Diamond Grade" reflective tape	Part No. 4019634	0 to 0.11 m	0 to 0.3 m	
Supply voltage V_S	10 to 30 VDC (limit values)			
Current consumption (no load)	<50 mA			
Ripple[1])	≦5 V_{pp}			
Light source	LED, visible red light, modulated, average service life 100,000 h[2])			
Light spot diameter	approx. 3.5 mm at a distance of 90 mm		approx. 40 mm at a distance of 1 m	
Light receiver switching mode	LIGHT- and DARK-switching			
Sensitivity	adjustable (270°-potentiometer)			
Signal strength indicator	LED			
Switching outputs Q and $\overline{Q}$	NPN	PNP	NPN	PNP
Signal voltage HIGH	approx. V_S	V_S – (≦1.5 V)	approx. V_S	V_S – (≦1.5 V)
Signal voltage LOW[3])	≦1.5 V	approx. 0 V	≦1.5 V	approx. 0 V
Output current max.	100 mA			
Response time[4]); switching frequency[5])	≦250 µs; max. 2000/s			
Enclosure rating	IP 67			
Circuit protection[6])	A, B, C			
Ambient operating temperature[7])	–25 to +55 °C			
Storage temperature [7])	–40 to +75 °C			
Connecting cable	2 m, 4 x 0.25 mm², PVC, O.D. 5 mm			
Weight (incl. cable)	approx. 100 g			

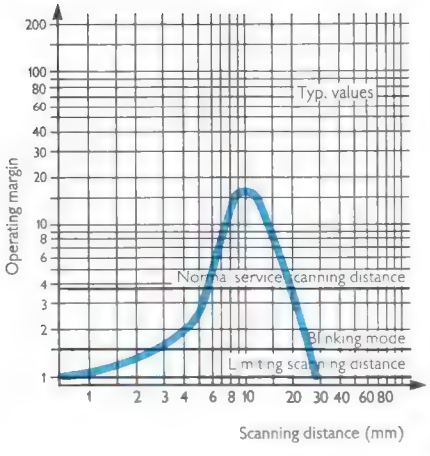
1) Must be within V_S tolerances
2) At room temperature = +25 °C
3) At room temperature = +25 °C and output current of 100 mA
4) With resistive load
5) With light/dark time ratio of 1:1
6) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
7) Do not distort cable below 0 °C

Scanning Range



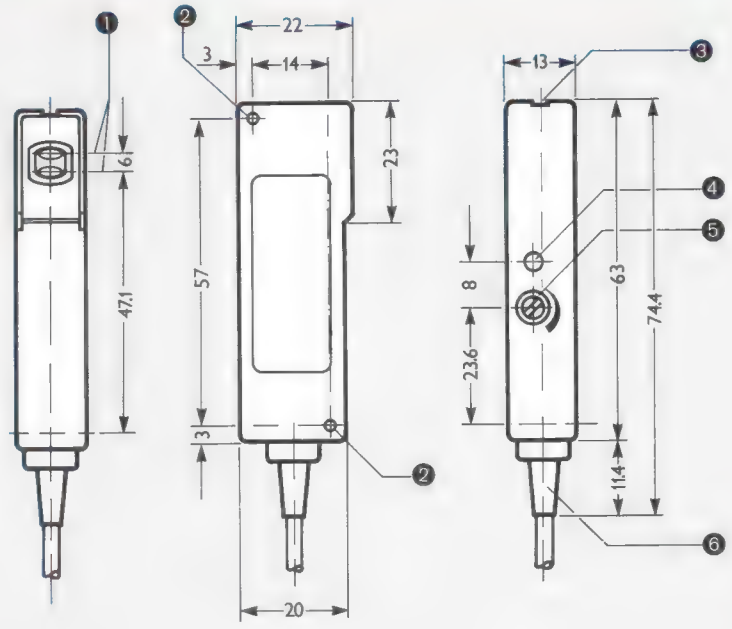
Features

- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$ (light- and dark-switching)
- Switching outputs short circuit protected, PNP or NPN
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



WT 9

Dimensions in mm

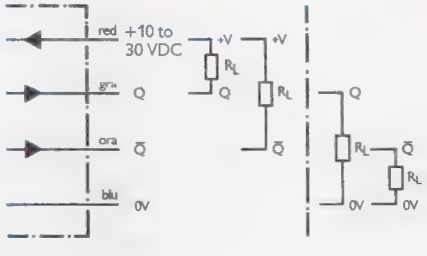


1 Centre of optical axis: point of intersection at a distance of approx. 15 mm
2 Mounting holes, I.D. 3.2 mm
3 Alignment sight
4 Signal strength indicator
5 Sensitivity control
6 Connecting cable, 2 m long

For mounting bracket (accessories), Part No. 2009120, see page 147.

Connection Diagram

WT 9 -N112, -P112



red	gra	ora	blu
red	gray	orange	blue

WT 9
Photoelectric Proximity Switch

WT 9	-N 112	-P 112
Part No.	1005705	1005704
Type of connection	cable	
Mounting bracket, Part No.	2009120	
Scanning range[1])	10 to 20 mm	
Supply voltage V_S	10 to 30 VDC (limit values)	
Current consumption (no load)	<50 mA	
Ripple[2])	≦5 V_{PP}	
Light source	LED, modulated infrared, average service life 100,000 h[3])	
Light spot diameter	3 mm at a distance of 15 mm	
Light receiver switching mode	LIGHT- and DARK-switching	
Sensitivity	adjustable (270°-potentiometer)	
Signal strength indicator	LED	
Switching outputs Q and $\overline{Q}$	NPN	PNP
Signal voltage HIGH	approx. V_S	V_S – (≦1.5 V)
Signal voltage LOW[4])	≦1.5 V	approx. 0 V
Output current max.	100 mA	
Response time[5]); switching frequency [6])	≦700 µs; max. 700/s	
Enclosure rating	IP 67	
Circuit protection[7])	A, B, C	
Ambient operating temperature [8])	–25 to +55 °C	
Storage temperature [8])	–40 to +75 °C	
Connecting cable	2 m, 4 x 0.25 mm², PVC, O.D. 5 mm	
Weight (incl. cable)	approx. 100 g	

1) Material with 6% reflectance (based on white standard, to DIN 5033)
2) Must be within V_S tolerances
3) At room temperature = +25 °C
4) At room temperature = +25 °C and output current of 100 mA
5) With resistive load
6) With light/dark time ratio of 1:1
7) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
8) Do not distort cable below 0 °C

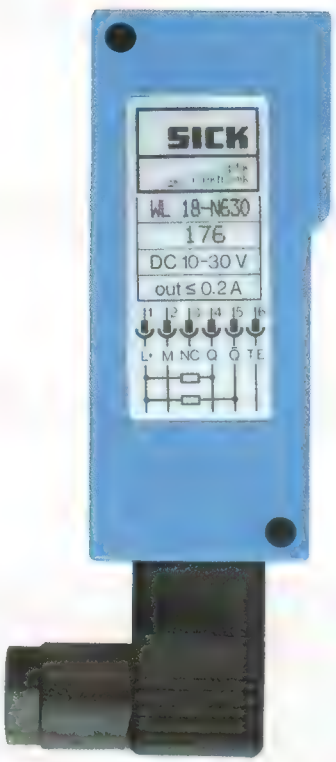
 WT 18 photoelectric proximity switch signalling jam

W 18-Series
Photoelectric Switches

WS/WE 18

WL 18

WT 18



Photoelectric switches in glassfiber-reinforced plastic housings. WT 18 photoelectric proximity switch with continuously adjustable scanning range and defined background suppression.

Polarizing filters on WL 18 reflex switch.

With sensitivity control on WL 18 and blinking LED signal strength indicator to show misalignment or dirty optics and to signal maintenance alarm.

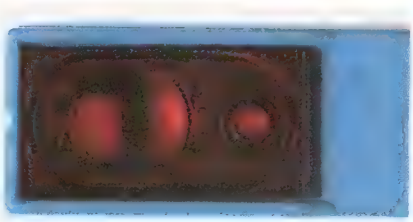
Available with non-detachable cable (enclosure rating IP 67) and 6-pin plug (enclosure rating IP 65). Supply voltage from 10 to 30 V.

Insensitive to ambient light through pulse modulation.

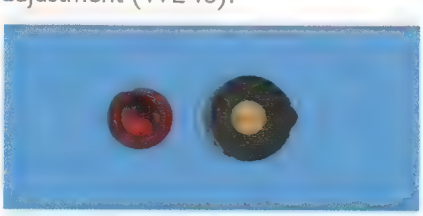
Complementary switching outputs for light- and dark-switching modes.

Outputs short circuit protected; NPN or PNP versions available.

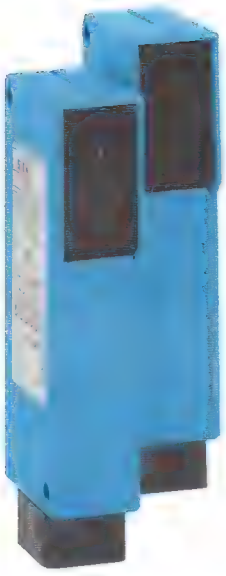
Available as through-beam photoelectric switches, as photoelectric reflex switches and as photoelectric proximity switches.



Alignment sight and signal strength indicator at front for simple adjustment (WL 18).



Signal strength indicator with sensitivity or background suppression control.



Scanning range

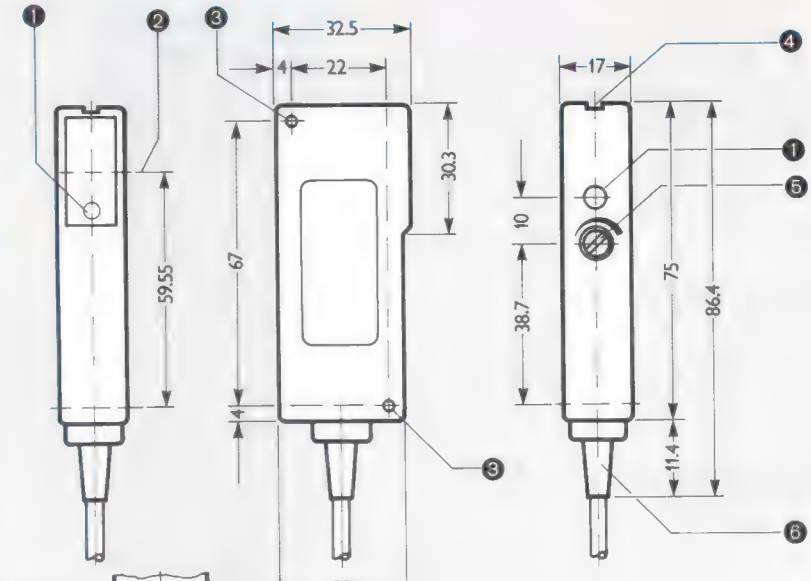
12 m

Features

- Blinking LED signal strength indicator to show misalignment or dirty optics and to signal maintenance alarm
- Supply connections reverse-polarity protected
- Power indicator for the light source (WS), signal strength indicator for the receiver (WE)
- Complementary switching outputs Q and $\overline{Q}$ for light- and dark-switching modes
- Switching outputs short circuit protected
- Insensitive to ambient light
- Test input for testing device and system
- No false triggering on power up
- Glassfiber-reinforced plastic housing

WS/WE 18

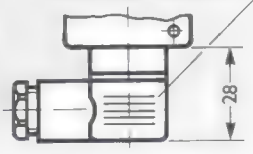
-N 132, -P 132



-P 430

For cable receptacle (accessories) see page 150

-N 630, -P 630



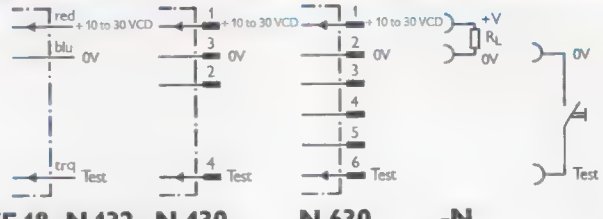
For cable receptacle (accessories) see page 150.

1. Power indicator (WS) Signal strength indicator (WE)
2. Center of optical axis
3. Mounting holes, I.D. 4.2 mm
4. Alignment sight
5. Sensitivity control, 270°-potentiometer
6. Connecting cable, 2 m long

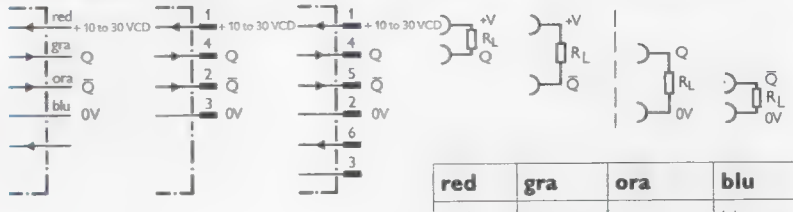
For mounting bracket (accessories) see page 147.

Connection Diagram

WS 18-D 132 -D 430 -D 630



WE 18 -N 132, -P 132 -N 430 -P 430 -N 630, -P 630 -N NPN -P PNP



red	gra	ora	blu
red	gray	orange	blue

Through-beam photoelectric switch

WS/WE 18	WS 18 -D 132	-D 430	-D 630	WE 18 -N 132	-N 630	-P 132	-P 430	-P 630
Part No.				1010908	1010910	1010909	1010824	1010911
Type of connection	Cable	4-pin plug	6-pin plug	Cable	6-pin plug	Cable	4-pin plug	6-pin plug
Cable receptacle	–	page 150	page 150	–	page 150	–	page 150	page 150
Mounting bracket , Part no.	2009317							
Scanning range[1]	12 m / 10 m							
Supply voltage Vs	10 to 30 VDC[2]							
Current consumption (no load)	≦ 30 mA			≦ 30 mA (WS), ≦ 35 mA (WE)				
Ripple[3]	≦ 5 V_{ss}							
Light source	LED, IR, modulated, av. service life 100,000 h[4]							
Transistor outputs				NPN, Q and $\overline{Q}$		PNP, Q and $\overline{Q}$		
Signal voltage HIGH				approx. V_S		V_S – (≦ 1.5 V)		
Signal voltage LOW[5]				≦ 1.5 V		approx. 0 V		
Output current I_A max.				100 mA				
Response time[6]; switching freq. max.[7]	≦ 500 µs; 1000/s							
Test input »TE«	light source deactivated							
Input resistance	≧ 22 kΩ							
Light source active	+V or not connected –							
Light source inactive	0 V –							
Enclosure rating	IP 67	IP 67	IP 65	IP 67	IP 65	IP 67	IP 67	IP 65
Circuit protection[8]	A, B, C							
Ambient operating temperature[9]	–25 to +55 °C							
Storage temperature[9]	–40 to +75 °C							
Connecting cable	2 m	–		2 m	–	2 m	–	–
Weight	approx. 100 g							

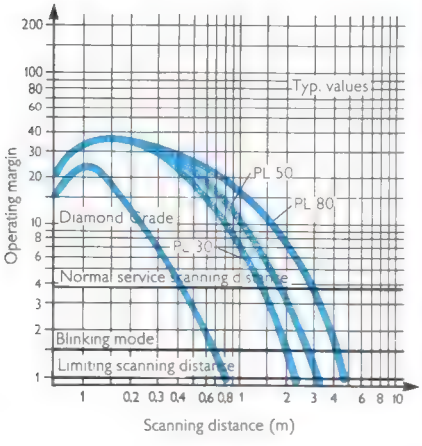
1) Typ. limit scanning distances (laboratory values)/ recommended normal service scanning distances
2) limit value
3) Must be within Vs tolerances
4) At room temperature = +25 °C
5) At room temperature = +25 °C and output current of 100 mA
6) Response time with resistive load
7) With light/dark ratio of 1:1
8) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
9) Do not distort cable below 0 °C

Scanning Distance

4 m

Features

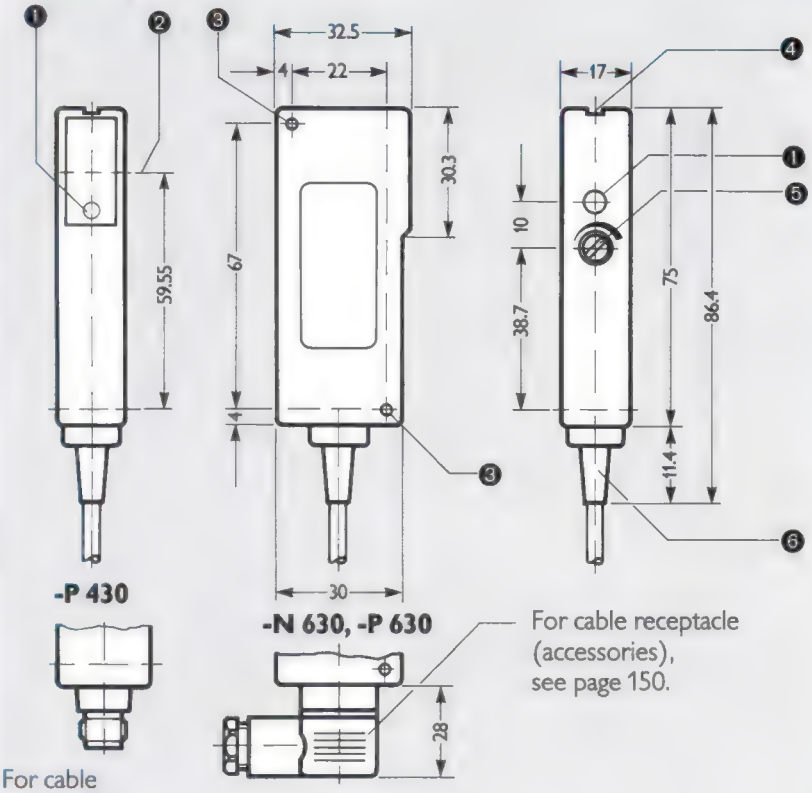
- Polarizing filters, enabling objects even with reflecting surfaces to be detected
- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$ (light- and dark-switching)
- Adjustable sensitivity
- Switching outputs short circuit protected
- Insensitive to ambient light
- Test input to test sensor on demand from remote location
- No false triggering on power-up
- Glassfiber-reinforced plastic housings



WL 18

-N 132, -P 132

Dimensions in mm



-P 430

-N 630, -P 630

For cable receptacle (accessories), see page 150.

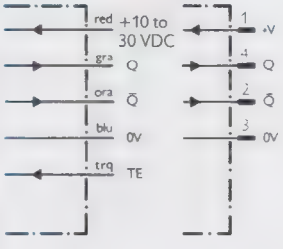
For cable receptacle (accessories) see page 150.

1. Signal strength indicator
2. Center of optical axis
3. Mounting holes, I.D. 4.2 mm
4. Alignment sight
5. Sensitivity control, 270°- potentiometer
6. Connecting cable, 2 m long

For reflectors (accessories), see page 144.
For mounting bracket (accessories), Part No. 2009317, see page 147.

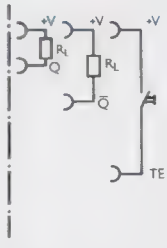
Connection Diagram

WL 18 -N 132, -P 132 -P 430

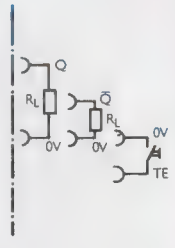


-N 630, -P 630

-N NPN



-P PNP



red	gra	ora	blu	trq
red	gray	orange	blue	turquoise

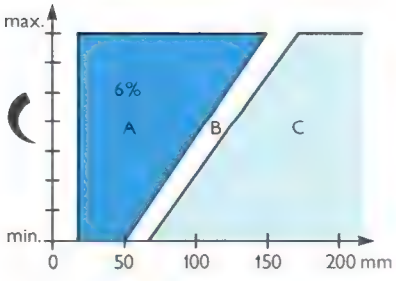
WL 18	-N 132	-N 630	-P 132	-P 430	-P 630
Part No.	1005 697	1006 385	1005 696	1001 818	1006 384
Type of connection	cable	6-pin plug	cable	4-pin plug	6-pin plug
Cable receptacle, Part No.	–	page 150	–	page 150	page 150
Mounting bracket, Part No.	2009 317				
Scanning range[1])					
With PL 80 reflector	Part No. 1003 865	0 to 4.0 m / 0 to 3.0 m			
With PL 50 reflector	Part No. 1000 132	0 to 2.8 m / 0 to 2.0 m			
With PL 30 reflector	Part No. 1002 314	0 to 2.0 m / 0 to 1.5 m			
With "Diamond Grade" reflective tape	Part No. 4019 634	0 to 0.8 m / 0 to 0.5 m			
Supply voltage V_S	10 to 30 VDC[2])				
Current consumption (no load)	≦ 50 mA				
Ripple[3])	≦ 5 V_{pp}				
Light source	LED, visible red light, modulated, average service life 100,000 h[4])				
Light spot diameter	approx. 40 mm at a distance of 2 m				
Switching outputs Q and $\overline{Q}$	NPN		PNP		
Signal voltage HIGH	approx. V_S		V_S – (≦ 1.5 V)		
Signal voltage LOW[5])	≦ 1.5 V		approx. 0 V		
Output current max.	200 mA				
Response time[6]); switching frequency [7])	≦ 500 µs; max. 1000/s				
Test input	light source deactivated			–	deactivated
Input resistance	≧ 15 kΩ			–	15 k Ω
Light source active	0 V or not connected		+ V or not con.	–	+ V
Light source inactive	+ V		0 V	–	0 V
Enclosure rating	IP 67	IP 65	IP 67		IP 65
Circuit protection[8])	A, B, C				
Ambient operating temperature[9])	–25 to +55 °C				
Storage temperature[9])	–40 to +75 °C				
Connecting cable	2 m	–	2 m	–	
Weight	approx. 100 g				

1) Typ. limiting scanning distances (laboratory values) / recommended normal service scanning distances under industrial conditions.
2) Limit values
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) At room temperature = +25 °C and output current of 100 mA
6) With resistive load
7) With light/dark time ratio of 1:1
8) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
9) Do not distort cable below 0 °C

Adjustable Scanning Distance

Features

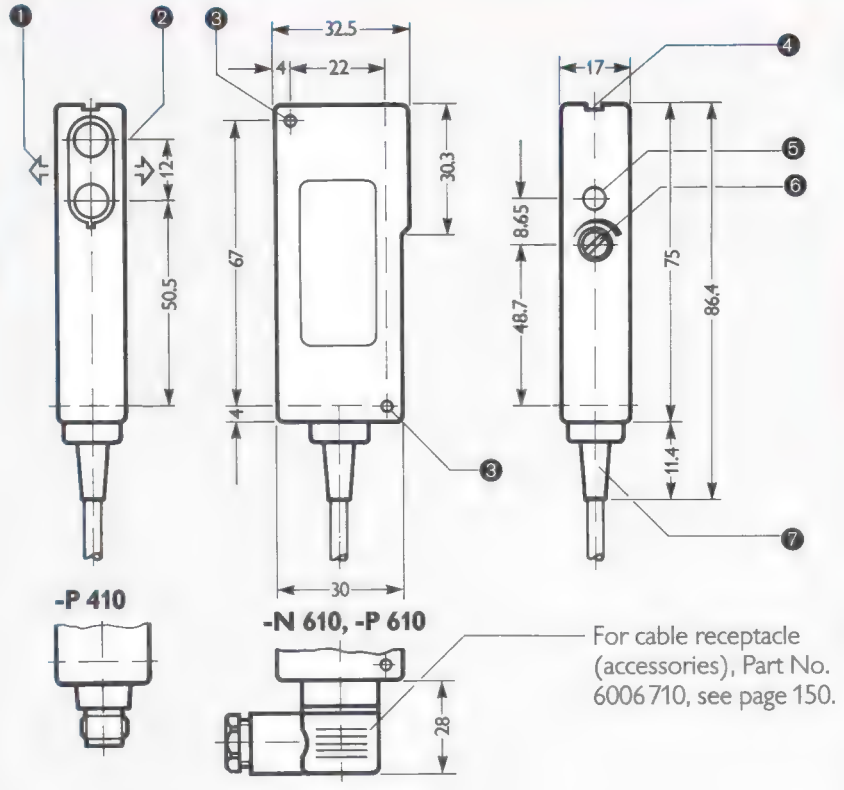
- Scanning range continuously adjustable
- Background suppression
- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$ (light- and dark-switching)
- Switching outputs short circuit protected
- Insensitive to ambient light
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



Background suppression
A = scanning range
B = background suppression range
C = background

WT 18

Dimensions in mm

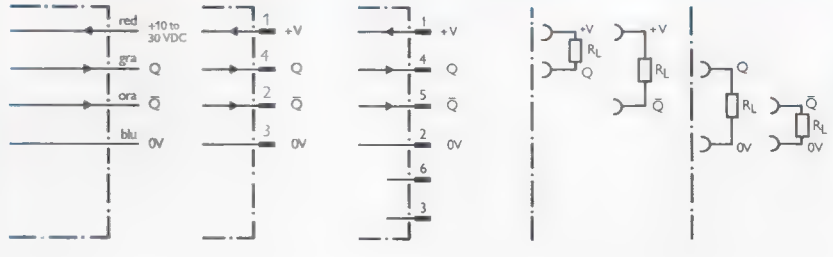


For cable receptacle (accessories) see page 150.

1. Direction of movement of object being scanned
2. Center of optical axis
3. Mounting holes, I.D. 4.2 mm
4. Alignment sight
5. Signal strength indicator
6. Scanning distance control (50 to 150 mm, approx. 2.5 turns)
7. Connecting cable, 2 m long

For mounting bracket (accessories), Part No. 2009 317, see page 147.

Connection Diagram



WT 18	-N 112	-N 610	-P 112	-P 410	-P 610
Part No.	1005 682	1006 381	1005 681	1010 817	1006 380
Type of connection	cable	6-pin plug	cable	4-pin plug	6-pin plug
Cable receptacle, Part No.	–	page 150	–	page 150	page 150
Mounting bracket, Part No.	2009 317				
Scanning distance, adjustable	**50 to 150 mm**				
Range[1]) with background suppression	20 to 50 / 20 to 150 mm				
Supply voltage V_S	10 to 30 VDC[2])				
Current consumption (no load)	≦ 50 mA				
Ripple[3])	≦ 5 V_{pp}				
Light source	LED, modulated infrared, average service life 100,000 h[4])				
Light spot diameter	approx. 5 mm at a distance of 150 mm				
Switching outputs Q and $\overline{Q}$	NPN		PNP		
Signal voltage HIGH	approx. V_S		V_S – (≦ 1.5 V)		
Signal voltage LOW[5])	≦ 1.5 V		approx. 0 V		
Output current max.	200 mA				
Response time[6]); switching frequency[7])	≦ 700 µs; max. 700/s				
Enclosure rating	IP 67	IP 65	IP 67	IP 65	IP 65
Circuit protection[8])	A, B, C				
Ambient operating temperature[9])	–25 to +55 °C				
Storage temperature [9])	–40 to +75 °C				
Connecting cable	2 m	–	2 m	–	
Weight	approx. 100 g				

1) Object with 6 % reflectance (based on standard white, to DIN 5033)
2) Limit values
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) At room temperature = +25 °C and output current of 100 mA
6) With resistive load
7) With light/dark time ratio of 1:1
8) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
9) Do not distort cable below 0 °C

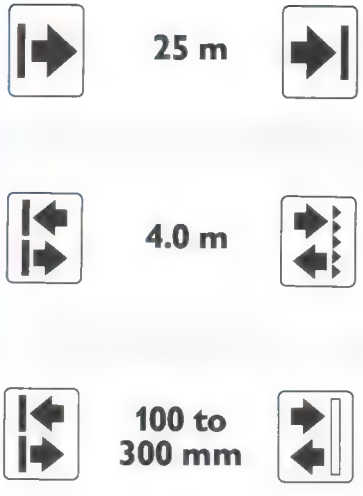
 WT 27 photoelectric proximity switches signal jam and release stopping device

W 27-Series
Photoelectric Switches with Extended Capabilities

WS 27/WE 27

WL 27

WT 27



Photoelectric switches in glassfiber-reinforced plastic housings. Photoelectric proximity switches with continuously adjustable scanning distance and defined background suppression.

Polarizing filters on WL 27 photoelectric reflex switch.

With sensitivity control and blinking LED signal strength indicator to show misalignment and dirt build-up on optics. Through-beam photoelectric switch with output to signal dirt build-up.

Available with non-detachable cable enclosure rating IP 65.

Supply voltage from 10 to 30 V direct voltage (transistor output) or 24 to 240 V direct and alternating voltage (relay output). Insensitive to ambient light through pulse modulation.

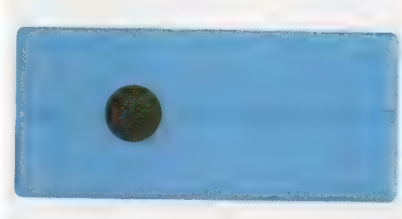
With test input to test sensor on demand from remote location.

Complementary switching outputs for light- and dark-switching modes.

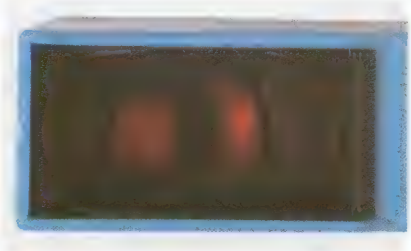
Direct-voltage version with two time ranges and time delay between 15 ms and 10 s (not on WL 27-F 132 and WT 27-F 112); universal-voltage version 0.5 to 10 s (not on WT 27-S 112).

Transistor outputs short circuit protected in NPN or PNP versions.

Available as through-beam photoelectric switches, photoelectric reflex switches and photoelectric proximity switches.



Choice of time delay between 15 ms and 10 s on direct-voltage version.



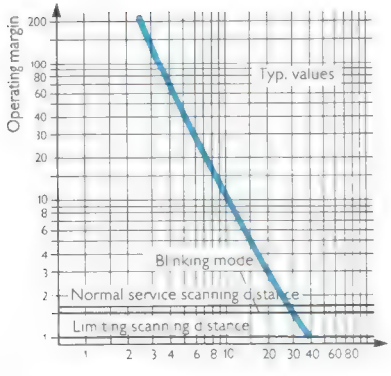
Alignment sight and signal strength indicator at front facilitate adjustment.

Scanning Distance

25 m

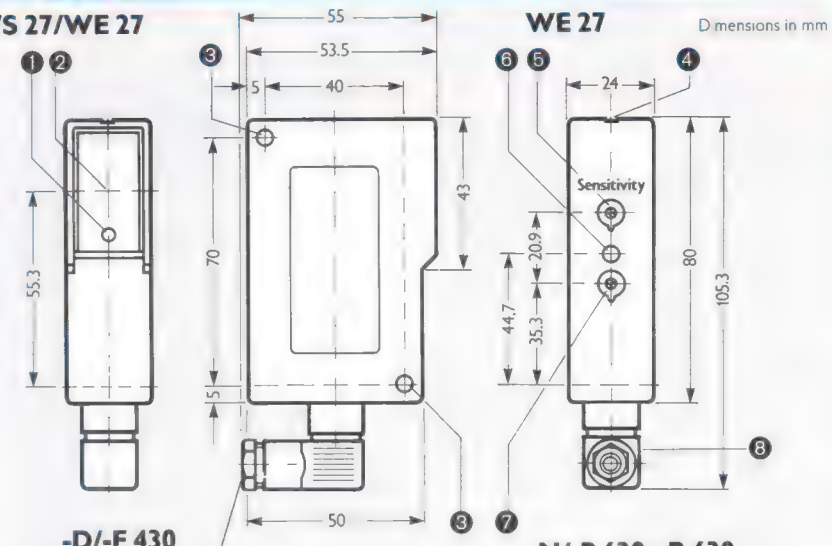
Features

- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Output to signal dirt build-up (N and P versions)
- Supply connections reverse-polarity protected
- Adjustable sensitivity
- Transistor outputs NPN or PNP, short circuit protected
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location (WS 27-D 630)
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



WS/WE 27

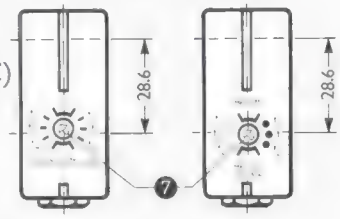
WS 27/WE 27 **WE 27** Dimensions in mm



-D/-F 430

For cable receptacle (accessories)
Part No. 6006710 (DC)
6006685 (AC/DC)
see page 150

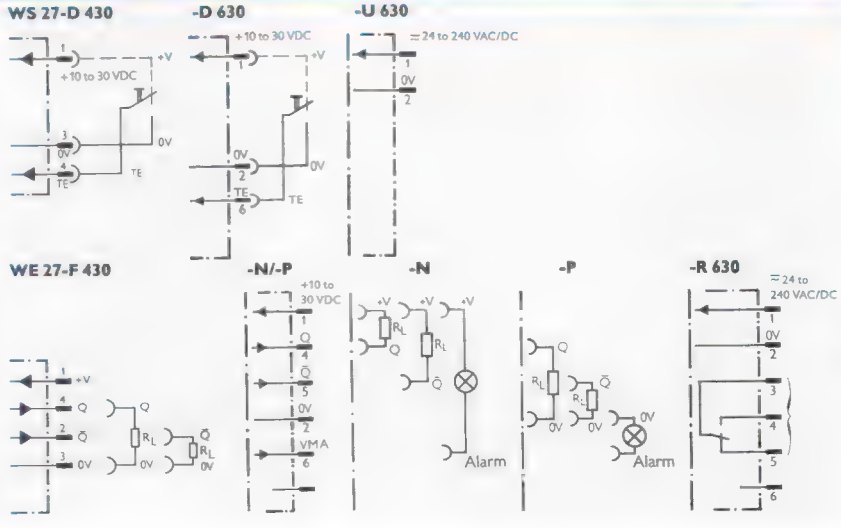
-N/-P 630 -R 630



1. Power indicator (WS)
   Signal strength indicator (WE)
2. Center of optical axis
3. Mounting holes, I.D. 5.2 mm
4. Alignment sight
5. Sensitivity control (WE), 270°- potentiometer
6. Signal strength indicator (WE)
7. Time control (WE), 270°-potentiometer
   Time-delay selector switch for DC; time-delay and light/dark selector for AC/DC.
8. Plug

For mounting bracket (accessories), Part No. 2009122, see page 147.

Connection Diagram



WS 27/WE 27
Through-beam Photoelectric Switch

Model WS 27/WE 27	WS 27 Sender -D 430	-D 630	-U 630	WE 27 Receiver -F 430	-N 630	-P 630	-R 630
Part No.				1010912	1010913	1010914	1010917
Type of connection	4-pin plug	6-pin plug		4-pin plug	4-pin plug		
Cable receptacle, Part No.	6007302/ 6007303	6007710	6006685	6007302/ 6007303	6006710		6006685
Mounting bracket, Part No.	2009122						
Scanning range	0 to 25 m						
Supply voltage V_S	10 to 30 VDC[1])		24 to 240 VAC/DC[2])	10 to 30 VDC[1])			24 to 240 VAC/DC[2])
Current consumption (no load) / Power cons.	≦ 40 mA		≦ 2 VA	≦ 40 mA	≦ 35 mA		≦ 2 VA
Ripple[3])	≦ 5 V_{pp}		–	≦ 5 V_{pp}	≦ 5 V_{pp}		–
Light source	IR LED, modulated, 100,000 h[4])			–			
Light spot diameter	appr. 1200 mm at a distance of 25 m			–			
Angle of dispersion/angle of reception	approx. 3°						
Switching outputs	–			PNP, Q+$\overline{Q}$	NPN, Q+$\overline{Q}$	PNP, Q+$\overline{Q}$	SPDT, floating[5])
Signal voltage HIGH/switching voltage max.	–			V_S – (≦ 1.5)	approx. V_S	V_S – (≦ 1.5)	250 VAC
Signal voltage LOW[6])/switching current max.	–			approx. 0 V	≦ 1.5 V	approx. 0 V	2.5 A
Output current max./switching power max.	–			200 mA			150 VA
Response time; switching frequency[7])	–			≦ 500 µs[8]); max. 1000/s			6 ms; max. 10/s
Pull-up resistance	–			10 kΩ		10 kΩ	–
Pull-down resistance	–			–	10 kΩ	–	–
Time delay	–			–	switch-selectable		
Switch position t_0	–			–	no time delay		
Switch position t_1 (or t_3)	–			–	delay from leading edge of object		
Switch position t_2 (or t_4)	–			–	delay from trailing edge of object		
Time delays	–			–	0.015 to 0.3 or 0.5 to 10 s		0.5 to 10 s
Adjustable with	–			–	270°-pot. and mode selec. switch		
Test input[9])	light source disconnected						
Input resistance	22 kΩ						
Light source ON	test input to V_S or not connected						
Light source OFF	test input to 0 V						
Output to signal dirt build-up: VMA[10])				–	NPN[11])	PNP[11])	–
Internal resistance				–	1.5 kΩ		–
Switching output: with signal reserve ≧ 50%				–	LOW	HIGH	–
Switching output: with signal reserve < 50%				–	LOW[12])	HIGH[12])	–
Enclosure rating	IP 65						
Circuit protection[13])	A, B, C	A		A, B, C			C
Ambient operating temperature	–25 to +55 °C						
Storage temperature	–40 to +70 °C						
Weight	approx. 100 g						

1) Limit values
2) +10%, –25%
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) Provide suitable arc suppression with inductive or capacitive loads
6) At room temperature = +25 °C and output current of 100 mA
7) With light/dark time ratio of 1:1; no time delay
8) With resistive load
9) Only WS 27-D 630
10) Only WS 27-N 630 and WS 27-P 630
11) Open collector
12) Switching to +V (NPN) or 0 V (PNP) periodically at 5 Hz
13) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ and VMA short circuit protected
C = interference suppression

Available on Request for Low Temperatures (down to –40 °C)

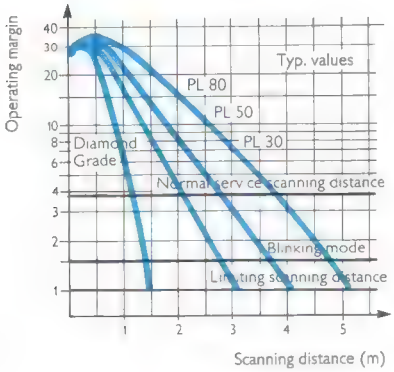
for 10 to 30 VDC	WE 27-N 6301 Part No. 1010915	WE 27-P 6301 Part No. 1010916

Scanning Distance

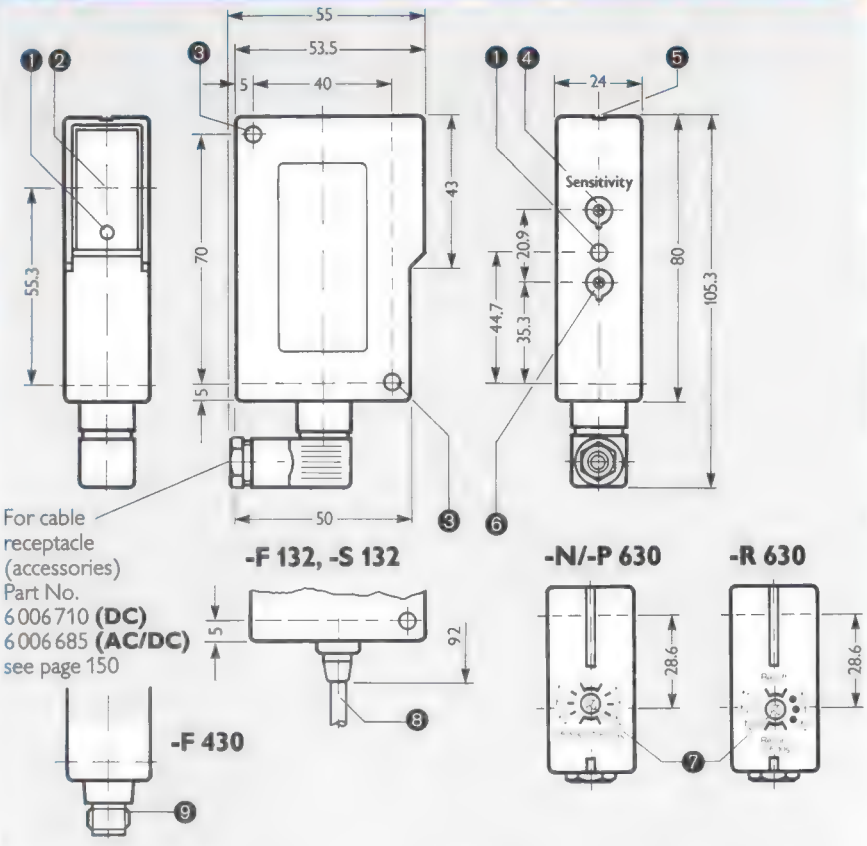
4.0 m

Features

- Polarizing filters, enabling objects even with reflecting surfaces to be detected
- Blinking LED indicator to show dirt build-up on optics
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\bar{Q}$ (light- and dark-switching) on WL 27-N, -P, -F
- Adjustable sensitivity (on WL 27-N, -P and -R)
- Transistor outputs short circuit protected, NPN or PNP
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location (WL 27-N, -P)
- No false triggering on power-up
- Glassfiber-reinforced plastic housing



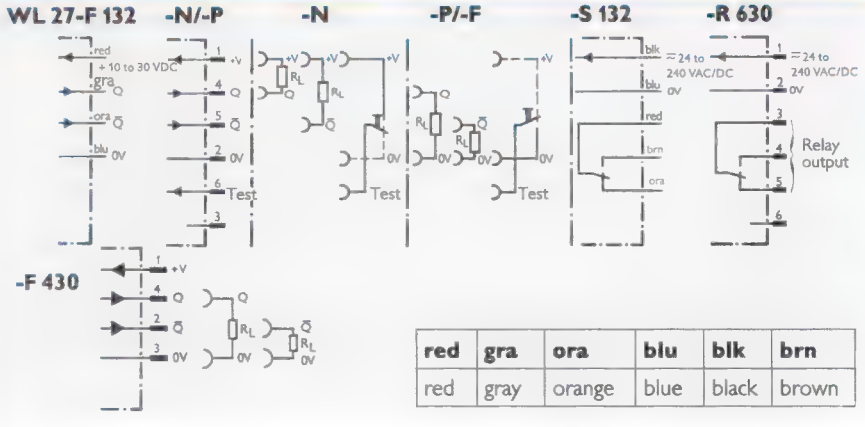
WL 27



1. Signal strength indicator
2. Center of optical axis
3. Mounting holes, I.D. 5.2 mm
4. Sensitivity control (on WL 27-N, -P and -R)
5. Alignment sight
6. Time control 0.5 to 10 s (on WL 27-N, -P and -R)
7. Time-delay selector switch for DC; time-delay and light/dark selector for AC/DC (not on WL 27-S)
8. Connecting cable (on WL 27-F 132, -S 132)
9. Connector

For mounting bracket (accessories), Part No. 2 009 122, see page 147.
For reflectors (accessories), see page 144.

Connection Diagram



red	gra	ora	blu	blk	brn
red	gray	orange	blue	black	brown

Photoelectric Reflex Switch

WL 27	-F1321	-F430	-P630	-N630	-R630	-S132
Part No.	1 006 376	1010443	1 005 806	1 005 805	1 005 804	1 006 375
Type of connection	cable	plug con. 4-pin	plug connector 6-pin			cable
Cable receptacle, Part No.	–	6 007 302/ 6 007 303	6 006 710	6 006 685		
Mounting bracket, Part No.	2 009 122					
Scanning range						
With PL 80 reflector	Part No. 1003865	0 to 4.0 m				
With C 110 reflector	Part No. 5304549	0 to 3.4 m				
With PL 50 reflector	Part No. 1000132	0 to 2.7 m				
With PL 30 reflector	Part No. 1002314	0 to 2.0 m				
With "Diamond Grade" reflective tape	Part No. 4019634	0 to 1.1 m				
Supply voltage V_S	10 to 30 VDC[1]				24 to 240 VAC/DC (+10%; –25%)	
Current consumption[2]/power cons.	≦ 50 mA				≦ 2 VA	
Ripple[3]	≦ 5 V_{pp}				–	
Light source	LED, visible red light, modulated, average service life 100,000 h[4]					
Light spot diameter	approx. 40 mm at a distance of 2.7 m					
Switching outputs	PNP, Q and $\overline{Q}$			NPN, Q and $\overline{Q}$	SPDT, isolated[5]	
Signal voltage HIGH/switching voltage max.	V_S – (≦ 1.5 V)			approx. V_S	250 VAC	
Signal voltage LOW[6]/switching current max.	approx. 0 V			≦ 1.5 V	2.5 A	
Output current max./switching power max.	200 mA				150 VA	
Pull-up resistance				10 kΩ	–	
Pull-down resistance	10 kΩ			–		
Response time[7]; switching frequency[8]	≦ 500 µs; max. 1000/s				max. 6 ms; max. 10/s	
Time delay	–		switch-selectable			–
Switch position t_0	–		no time delay			–
Switch position t_1 (or t_3)	–		delay from leading edge of object			–
Switch position t_2 (or t_4)	–		delay from trailing edge of object			–
Time delays	–		0.015 to 0.3 s or 0.5 to 10 s		0.5 to 10 s	–
Test input	–		light source deactivated		–	
Input resistance	–		15 kΩ	22 kΩ	–	
Light source ON test input to		–	V_S	0 V	–	
Light source OFF test input to		–	0 V	V_S	–	
Enclosure rating	IP 65					
Circuit protection[9]	A, B, C				C	
Ambient operating temperature[10]	–25 to +55 °C					
Storage temperature[10]	–40 to +70 °C					
Connecting cable	[11]	–				[11]
Weight	approx. 100 g					

1) Limit values
2) No load
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) Provide suitable arc suppression with inductive or capacitive loads
6) At room temperature = +25 °C and output current of 100 mA
7) With resistive load
8) With light/dark time ratio of 1:1, no time delay
9) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short-circuit protected
C = interference suppression
10) Do not distort cable below 0 °C
11) 2 m, 4 x 0.25 mm², PVC, O.D. 5 mm

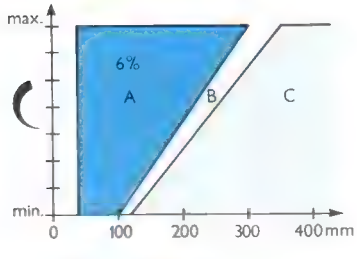
Available on Request for Low Temperatures (down to –40 °C)		
for 10 to 30 VDC with cable	WL 27-F1321 Part No. 1010015	
for 10 to 30 VDC with plug	WL 27-P6301 Part No. 1010018	WL 27-N6301 Part No. 1010017

Adjustable Scanning Distance

100 to 300 mm

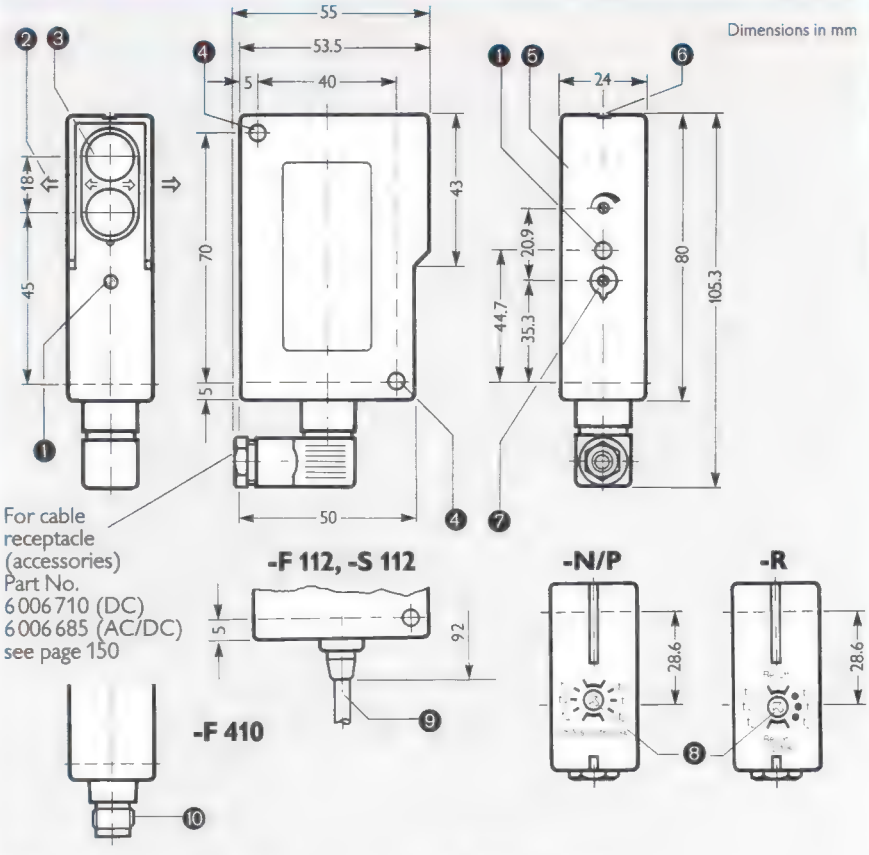
Features

- Scanning distance continuously adjustable
- Background suppression
- Blinking LED signal strength indicator to show dirt build-up on optics
- Supply connections reverse-polarity protected
- Switching outputs light- and dark-switching
- Transistor outputs PNP or NPN, short circuit protected
- Insensitive to ambient light
- Switch-selectable time delay (not on WT 27-F and -S)
- Test input to test sensor on demand from remote location (not on WT 27-F, -S and -R)
- No false triggering on power-up
- Glassfiber-reinforced plastic - housing



Background suppression
A = scanning range
B = background suppression range
C = background

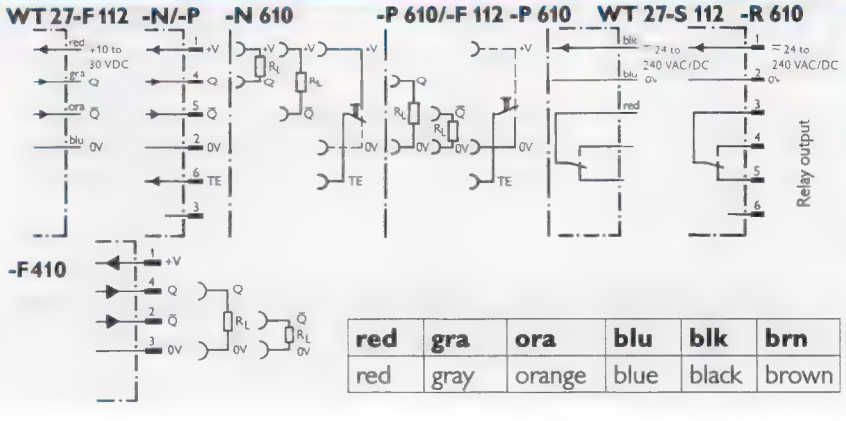
WT 27



1. Signal strength indicator
2. Direction of movement of object being scanned
3. Center of optical axis
4. Mounting holes, I.D. 5.2 mm
5. Scanning distance control
6. Alignment sight
7. Time control (on WT 27-N, -P and -R)
8. Time-delay switch for DC; time-delay and light/dark selector for AC/DC
9. Connecting cable
10. Connector

For mounting bracket (accessories), Part No. 2 009 122, see page 147.

Connection Diagram



red	gra	ora	blu	blk	brn
red	gray	orange	blue	black	brown

WT 27
Photoelectric Proximity Switch

WT 27	-F112	-F410	-P610	-N610	-R610	-S112
Part No.	1 006 378	1010444	1 005 803	1 005 802	1 005 801	1 006 377
Type of connection	cable	plug con. 4-pin	plug connector 6-pin			cable
Cable receptacle, Part No.		6007 302/ 6007 303	6 006 710		6 006 685	
Mounting bracket, Part No.	2 009 122					
Scanning distance, adjustable	100 to 300 mm					
Scanning range[1] with background suppress.	30 to 100/30 to 300 mm					
Supply voltage V_S	10 to 30 VDC[2]				24 to 240 VAC/DC (+10%, –25%)	
Current consumption[3]/power cons.	< 50 mA				≦ 2 VA	
Ripple[4]	≦ 5 V_{pp}				–	
Light source	LED, infrared, modulated, average service life 100,000 h[5]					
Light spot diameter	approx. 10 mm at a distance of 300 mm					
Switching outputs	PNP, Q and $\overline{Q}$			NPN, Q and $\overline{Q}$	SPDT, isolated	
Signal voltage HIGH/switching voltage max.	V_S – (≦ 1.5 V)			approx. V_S	250 VAC	
Signal voltage LOW[6]/switching current max.	approx. 0 V			≦ 1.5 V	2.5 A	
Output current max./switching power max.	200 mA				150 VA	
Pull-up resistance				10 kΩ		
Pull-down resistance			10 kΩ	–	–	
Response time[7]; switching frequency[8]	max. 2 ms; max. 250/s				max. 6 ms; max. 10/s	
Time delay[9]	–		switch-selectable		–	
Switch position t_0	–		no time delay			–
Switch position t_1 (or t_3)	–		delay from trailing edge of object		–	
Switch position t_2 (or t_4)	–		delay from leading edge of object		–	
Time delays	–		0.015 to 0.3 s or 0.5 to 10 s		0.5 to 10 s	–
Test input[10]	–		light source deactivated		–	
Input resistance	–		22 kΩ		–	
Light source ON test input to		–	V_S	0 V		
Light source OFF test input to		–	0 V	V_S		
Enclosure rating	IP 65					
Circuit protection[11]	A, B, C				C	
Ambient operating temperature[12]	–25 to +55 °C					
Storage temperature[12]	–40 to +75 °C					
Connecting cable	[13]		–			[13]
Weight	approx. 100 g					

1) Object with 6% reflectance (based on white standard, to DIN 5033)
2) Limit value
3) No load
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) At room temperature = +25 °C and output current of 100 mA
7) With resistive load
8) With light/dark time ratio of 1:1
9) Only WT 27-N, -P and -R
10) Only WT 27-N and -P
11) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short-circuit protected
C = interference suppression
12) Do not distort cable below 0 °C
13) 2 m, 4 x 0.25 mm², PVC, O.D. 5 mm

Available on Request for Low Temperatures (down to –40 °C)		
for 10 to 30 VDC with cable	WT 27-F1121 Part No. 1010020	
for 10 to 30 VDC with plug	WT 27-P6101 Part No. 1010023	WT 27-N6101 Part No. 1010022


SICK
SICK
SICK

W 36-Series
Heavy-duty Photoelectric Switches

WS 36/WE 36

WL 36

WT 36

50 m

10 m

800 mm

Photoelectric switches in glassfiber-reinforced plastic housings. Photoelectric reflex switches with polarizing filters; photoelectric proximity switches with adjustable scanning distance and defined background suppression.

Through-beam photoelectric switch with long scanning distance.

With sensitivity control and blinking LED signal strength indicator to show misalignment and dirt build-up on optics.

With terminal chamber (cable gland PG 13.5) conforming to IP 67 (dusttight, watertight); also available with plug to IP 65 (dusttight, waterproof).

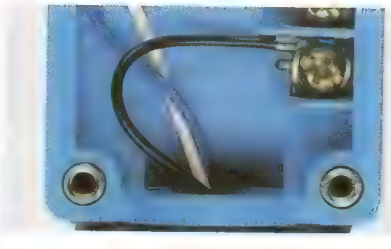
Supply voltage from 10 to 30 V direct voltage (transistor output) or 24 to 240 V direct and alternating voltage (relay output).

Insensitive to ambient light through pulse modulation.

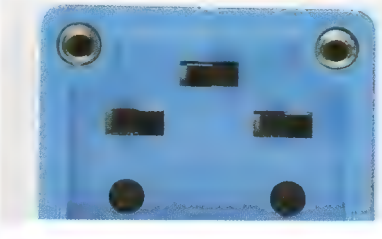
Transistor outputs for NPN and PNP mode, short circuit protected. Switchable to light- or dark-switching.

With time delay between 20 ms and 1 s; universal-voltage version 0.5 to 12 s.

Available as through-beam photoelectric switch, photoelectric reflex switch and photoelectric proximity switch.



Terminal chamber permits individual wiring.



Controls for time delay, switching mode and sensitivity.

Scanning Distance

50 m

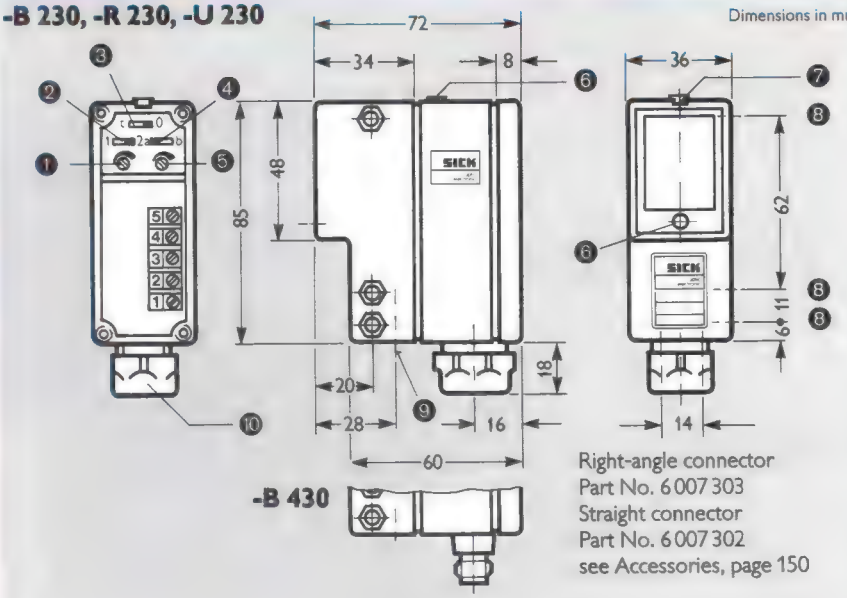
Features

- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Output to signal dirt build-up (on WE 36-B)
- Supply connections reverse-polarity protected
- Adjustable sensitivity
- Transistor outputs NPN and PNP, short circuit protected
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location (not on WS 36-U)
- No false triggering on power-up
- Choice of light/dark switching
- Direct and alternating voltage supply
- Glassfiber-reinforced plastic housing

WS 36 / WE 36

-B 230, -R 230, -U 230

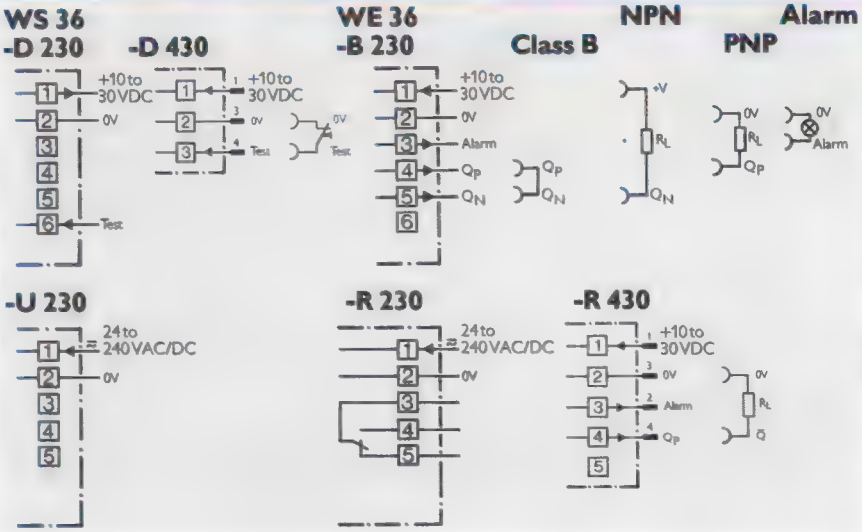
Dimensions in mm



Right-angle connector
Part No. 6 007 303
Straight connector
Part No. 6 007 302
see Accessories, page 150

1. Time control, 270°-potentiometer
2. Time delay
   1 from trailing edge of object
   2 from leading edge of object
3. Time delay ON (t) and OFF (0)
4. Light/dark selector
   a = light-switching
   b = dark-switching
5. Sensitivity control, 270°-potentiometer
6. Power indicator (WS)
   Signal strength indicator (WE)
7. Alignment sight
8. Mounting holes through enclosure, recessed on both sides for M5 hex nut
9. Threaded mounting holes M5, 5.5 mm deep
10. PG 11 cable gland
    (for cable diameter 5 to 12 mm)

Connection Diagram



Through-beam photoelectric switch
WS 36/WE 36

WS 36 / WE 36	WS 36 Sender			WE 36 Receiver		
Model	**-D 230**	**-D 430**	**-U 210**	**-B 230**	**-B 430**	**-R 230**
Part No.				1010922	1011107	1010978
Type of connection (T/P)[1]	T	P, 4-pin	T	T	P, 4-pin	T
Cable receptacle, Part No.	=	6007302 6007303	–	–	6007302 6007303	–
Mounting bracket, Part No.	2005806					
Scanning distance	50 m					
Supply voltage V_S	10 to 30 VDC[2]		24 to 240 VAC/DC[3]	10 to 30 VDC[2]		24 to 240 VAC/DC[3]
Current consumption/power consumption	<40 mA		<2 VA	<40 mA		<2 VA
Ripple[4]	≦5 V_{pp}			≦5 V_{pp}		–
Light source	LED, infrared, modulated, average service life 100,000 h[5]					
Light spot diameter	approx. 1300 mm at a distance of 25 m					
Switching outputs[6]	–			PNP/NPN		SPDT, isolated[7]
Signal voltage HIGH/switching voltage max.	–			$+V_S$ – (≦1.5)[8]		250 VAC
Signal voltage LOW[9]/switching current max.	–			<1.5 V[10]		3 A
Output current max./switching power max.	–			200 mA		500 VA
Response time[11], switching frequency max.[12]	–			≦2.5 ms; 400/s		≦20 ms; 10/s
Time delay				switch-selectable		
Switch position 1 2	–			delay from trailing edge of object delay from leading edge of object		
Time delays	–			0.02 to 1 s		0.5 to 12 s
Alarm output	–			dirt build-up signalling		
PNP output with current limitation	–			open collector/1.5 kΩ		
"Sufficient" light received (signal reserve ≧50%)	–			output HIGH (V_S –1.5 V)		
"Insufficient" light received	–			switching to V_S periodically at 5 Hz		
Test input	sender deactivated		–	–		
Internal resistance	15 kΩ					
Light source "active" V_{TEST}	$+V_S$ or not connected		–			
Light source "inactive" V_{TEST}	0 V		–			
Enclosure rating	IP 67		IP 67	IP 67		IP 67
Circuit protection[13]	A			A, B, C		–
Ambient operating temperature[14]	–25 to +55 °C					
Storage temperature[14]	–40 to +70 °C					
Weight	approx. 160 g					

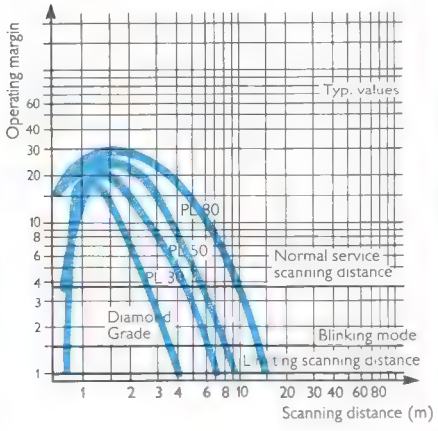
1) T = terminal chamber; P = plug connector
2) Limit values
3) +10%, –25%
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) Referred to switch position a:
with uninterrupted beam HIGH,
with interrupted beam LOW
7) Provide suitable arc suppression with inductive or capacitive loads
8) NPN output: $+V_S$
9) At room temperature = +25 °C and output current of 100 mA
10) PNP output: +0.1 V
11) With resistive load
12) With light/dark time ratio of 1:1; no time delay
13) A = supply connections reverse-polarity protected
B = outputs Q_N and $\overline{Q}_P$ short circuit protected
C = interference suppression
14) Do not distort cable below 0 °C

Scanning Distance

10 m

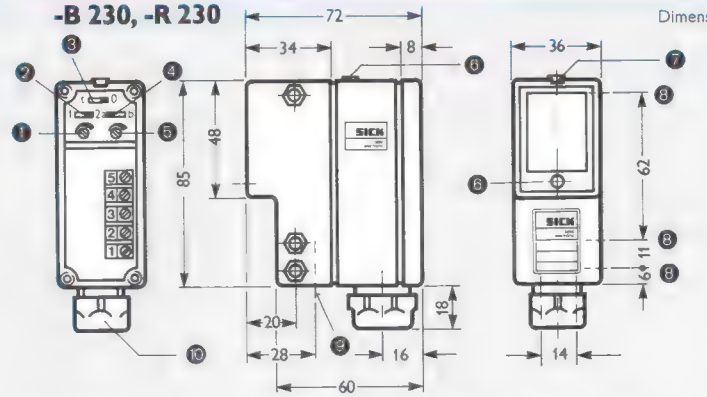
Features

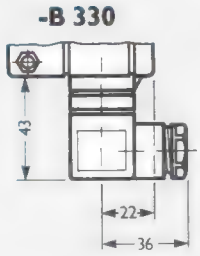
- Polarizing filters, enabling objects even with reflecting surfaces to be detected
- Blinking LED signal strength indicator to show dirt build-up on optics
- Supply connections reverse-polarity protected
- Choice of light/dark switching
- Adjustable sensitivity
- Transistor outputs short circuit protected, NPN or PNP
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location (on WL 36-B)
- No false triggering on power-up
- Direct and alternating voltage supply (WL 36-R)
- Glassfiber-reinforced plastic housing

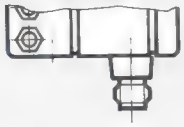


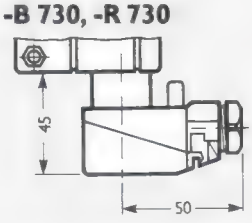
WL 36

Dimensions in mm









For cable receptacle (accessories), Part No. 6 005 698, see page 150.

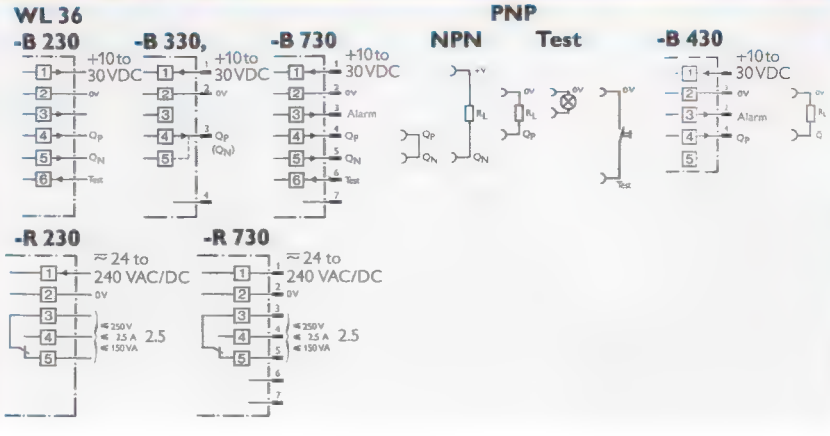
For cable receptacle (accessories), Part No. 6 006 823 (-B 730), Part No. 6 006 821 (-R 730), see page 150.

❶ Time control, 270°-potentiometer
❷ Time delay
1 from trailing edge of object
2 from leading edge of object
❸ Time delay ON (t) / OFF (0)
❹ Light/dark selector
a = light-switching
b = dark-switching
❺ Sensitivity control, 270°- potentiometer
❻ Signal strength indicator at front and top
❼ Alignment sight
❽ Mounting holes through enclosure, recessed on both sides for M5 hex nut
❾ Threaded mounting holes M5, 5.5 mm deep
❿ PG 11 cable gland (for cable diameter 5 to 12 mm)

For mounting bracket (accessories), Part No. 2 005 806, see page 147.

For reflectors (accessories), see page 144.

Connection Diagram



WL 36
Photoelectric Reflex Switch

WL 36	-B 230	-B 430	-B 730	-B 330	-R 230	-R 730
Part No.	1005 385	1010 612	1008 848	1005 787	1005 387	1008 849
Type of connection (T/P)[1]	T	P, 4-pin	P, 7-pin	P, 3-pin	T	P, 7-pin
Cable receptacle, Part No.	–	6007 302 6007 303	6006 823	6005 698	–	6006 821
Mounting bracket, Part No.	2005 806					
Scanning range						
With PL 80 reflector	Part No. 1003 865		0.1 to 10 m			
With C 110 reflector	Part No. 5304 549		0.3 to 9 m			
With PL 50 reflector	Part No. 1000 132		0.1 to 6.5 m			
With PL 30 reflector	Part No. 1002 314		0.1 to 5 m			
With "Diamond Grade" reflective tape	Part No. 4019 634		0.25 to 3 m (min. 200 x 200 mm^2 area)			
Supply voltage V_S	10 to 30 VDC[2])				24 to 240 VAC/DC (+10%, –25%)	
Current consumption/power consumption	< 40 mA				≦ 2 VA	
Ripple[3])	< 5 V_{pp}				–	
Light source	LED, visible red light, modulated, average service life 100,000 h[4])					
Light spot diameter	approx. 50 mm at a distance of 3 m					
Switching outputs[5])	PNP/NPN	PNP	PNP/NPN		SPDT, isolated[6])	
Signal voltage HIGH/switching voltage max.	V_S – (≦ 1.5)[7])				250 VAC	
Signal voltage LOW[8])/switching current max.	≦ 1.5 V[9])				3 A	
Output current max./switching power max.	200 mA				500 VA	
Response time[10])	≦ 1.25 ms[11])				< 20 ms	
Switching frequency max.[12])	400/s				10/s	
Time delay	switch-selectable					
Switch position 1/2	delay from trailing edge of object / delay from leading edge of object					
Time delays	0.02 to 1 s				0.5 to 12 s	
Alarm output	PNP, open collector				–	
Internal resistance	≧ 1.5 kΩ ± 5%					
"Sufficient" light received (signal reserve ≧ 50%)	output HIGH (V_S – 1.5 V)				–	
"Insufficient" light received	switching to V_S periodically at 5 Hz		–		–	
Test input	light source deactivated by switching to 0 V				–	
Internal resistance	≧ 15 kΩ					
Enclosure rating	IP 67	IP 67			IP 67	IP 65
Circuit protection[13])	A, B, C				–	
Ambient operating temperature[14])	–25 to +55 °C					
Storage temperature[14])	–40 to +70 °C					
Weight	165 g					

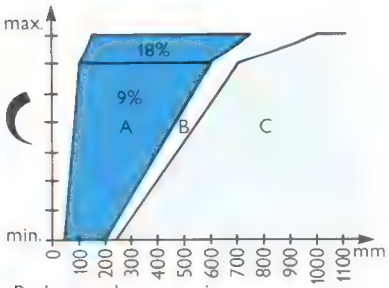
1) T = terminal chamber, P = plug connector
2) Limit values
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) Referred to switch position a:
with uninterrupted beam HIGH,
with interrupted beam LOW
6) Provide suitable arc suppression with inductive or capacitive loads
7) NPN output: +V_S
8) At room temperature = +25 °C and output current of 100 mA
9) PNP output: +0.1 V
10) No time delay
11) With resistive load
12) With light/dark time ratio of 1:1; no time delay
13) A = supply connections reverse-polarity protected
B = outputs Q_P and $\overline{Q}_N$ short circuit protected
C = interference suppression
14) Do not distort cable below 0 °C

Adjustable Scanning Distance

200 to 800 mm

Features

- Continuously adjustable scanning distance
- Background suppression
- Blinking LED signal strength indicator to show misalignment and dirt build-up on optics
- Supply connections reverse-polarity protected
- Light/dark switching by complementary outputs Q and $\overline{Q}$ (WT 36-N, -P), or switch-selectable (WT 36-R)
- Transistor outputs short circuit protected
- Insensitive to ambient light
- Switch-selectable time delay
- Test input (not on WT 36-R)
- No false triggering on power-up
- Direct and alternating-voltage supply (WT 36-R)
- Glassfiber-reinforced plastic housing

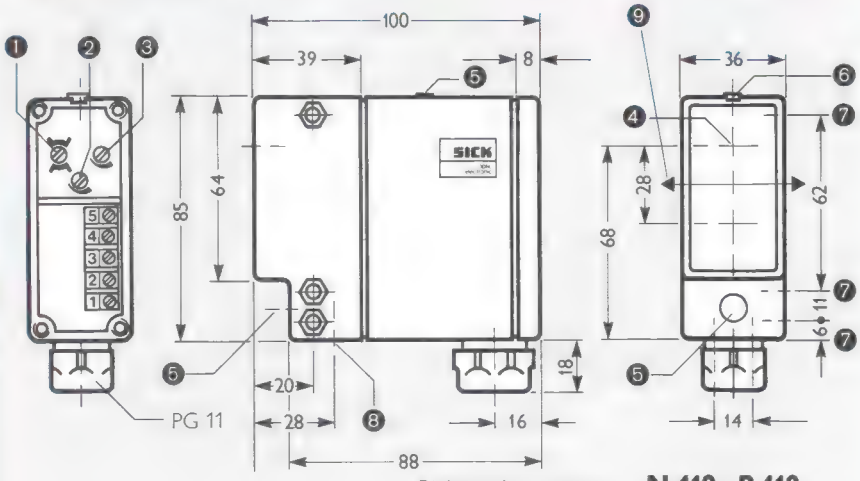


Background suppression
A = scanning range
B = background suppression range
C = background

WT 36

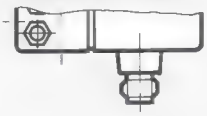
-N 210, -P 210, -R 210

Dimensions in mm

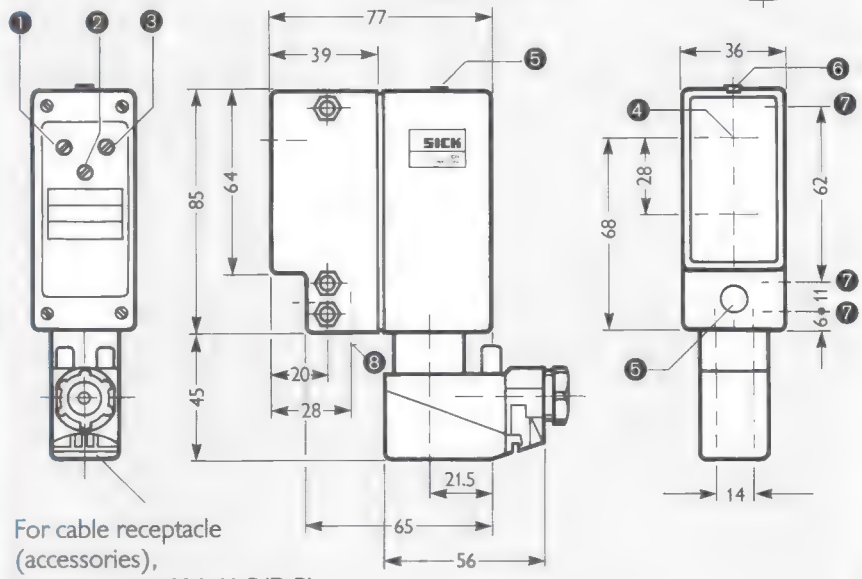


Right-angle connector
Part No. 6 007 303
Straight connector
Part No. 6 007 302
page 150

-N 410, -P 410



-N 710, -P 710, -R 710



For cable receptacle (accessories),
Part No. 6 006 821 (AC/DC)
Part No. 6 006 823 (DC)
see page 150.

❶ Selector switch:
time delay for DC
time delay and light/dark selection for AC/DC

❷ Scanning distance control, approx. 2½ turns from min. to max.

❸ Time control, 270°-potentiometer

❹ Center of optical axis

❺ Signal strength indicator at front and top

❻ Alignment sight

❼ Mounting holes through enclosure, recessed on both sides for M5 hex nut

❽ Threaded mounting holes M5, 5.5 mm deep

❾ Direction of movement of object being scanned

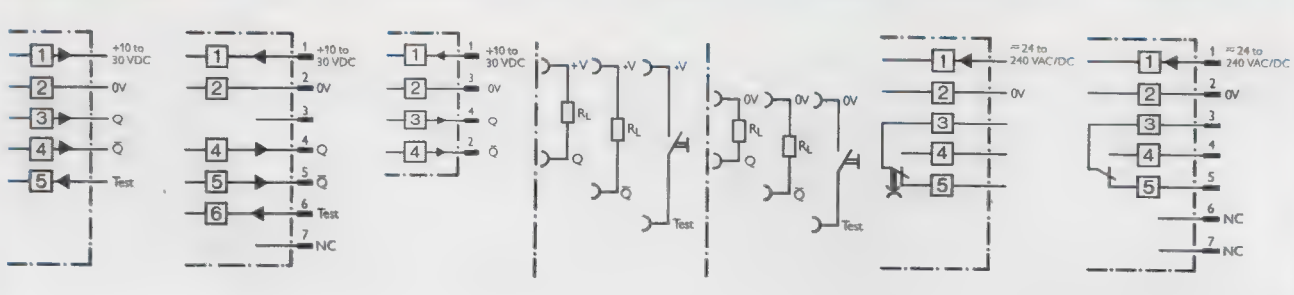
For mounting bracket (accessories), Part No. 2 005 806, see page 147.

WT 36
Photoelectric Proximity Switch

WT 36	-N 210	-N 710	-N 410	-P 210	-P 710	-P 410	-R 210	-R 710
Part No.	1010109	1006370	1011109	1010108	1006047	1011108	1010110	1005927
Type of connection (T/P)[1]	T	P, 7-pin	P, 4-pin	T	P, 7-pin	P, 4-pin	T	P, 7-pin
Cable receptacle, Part No.		6006823	6007302 6007303		6006823	6007302 6007303		
Mounting bracket, Part No.	2005806							
Scanning distance, adjustable	200 to 800 mm							
Scanning range with background suppression	see diagram							
Supply voltage V_S	10 to 30 VDC[2]						24 to 240 VAC/DC[3]	
Current consumption/power consumption	≦50 mA						≦2 VA	
Ripple[4]	≦5 V_{pp}						–	
Light source	LED, infrared, modulated, average service life 100,000 h[5]							
Light spot diameter	approx. 15 mm at a distance of 800 mm							
Switching outputs	NPN, Q + $\overline{Q}$			PNP, Q + $\overline{Q}$			SPDT, isolated[6]	
Signal voltage HIGH/switching voltage max.	approx. V_S			V_S – (≦1.5)			250 VAC	
Signal voltage LOW[7]/switch. current max.	≦1.5 V			approx. 0 V			2.5 A	
Output current max./switch. power max.	200 mA						150 VA	
Response time[8]	≦2 ms						≦6 ms	
Switching frequency max.[9]	250/s						10/s	
Time delay	switch-selectable							
Switch position t_0	no time delay							
Switch position t_1 (or t_3)	delay from trailing edge of object							
Switch position t_2 (or t_4)	delay from leading edge of object							
Time delays	t_1, t_2: 0.015 to 0.3 s; t_3, t_4: 0.5 to 12 s						0.5 to 12 s	
Test input	light source deactivated						–	
Internal resistance	≧ 22 kΩ							
Enclosure rating	IP 67	IP 65	IP 67	IP 67	IP 65	IP 67	IP 67	IP 65
Circuit protection[10]	A, B, C						–	
Ambient operating temperature[11]	–25 to +55 °C							
Storage temperature[11]	–40 to +70 °C							
Weight	approx. 200 g							

1) T = terminal chamber; P = plug connector
2) Limit value
3) +10%, –25%
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) Provide suitable arc suppression with inductive or capacitive loads
7) At room temperature = +25 °C and output current of 100 mA
8) With resistive load
9) With light/dark time ratio of 1:1; no time delay
10) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression
11) Do not distort cable below 0 °C

Connection Diagram



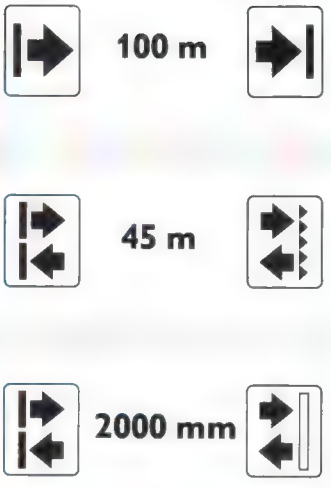
WT 45 photoelectric proximity switch with cooler monitoring the paper web in extremely difficult conditions

W 45-Series
Photoelectric Switches

WS 45/WE 45

WL 45

WT 45



Photoelectric switches with metal housing. Photoelectric reflex switch with polarizing filters.

Photoelectric proximity switch with adjustable scanning distance and defined background suppression.

Through-beam photoelectric switch with built-in optical alignment facility.

With sensitivity control and blinking LED signal strength indicator to show misalignment and dirt build-up on optics.

With terminal chamber (cable gland PG 13.5) conforming to enclosure rating IP 67 (also available with 7-pin plug, to IP 65.

Supply voltage 10 to 60 V direct voltage (transistor output) or 24 to 240 V direct and alternating voltage (relay output).

Insensitive to ambient light through pulse modulation.

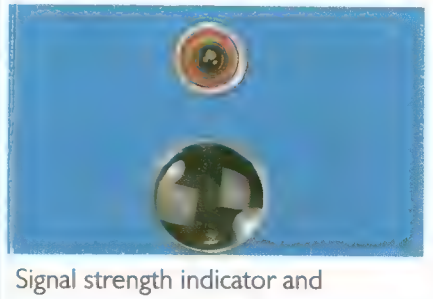
Transistor outputs available in NPN and PNP configurations, complementary for light- and dark-switching. In relay version, choice of light- and dark switching.

With time delay between 15 ms and 12 s; universal voltage version 0.5 to 12 s.

Transistor outputs short circuit protected.

Available as through-beam photoelectric switch, photoelectric reflex switch and photoelectric proximity switch.

Terminal chamber with controls for time delay and sensitivity.



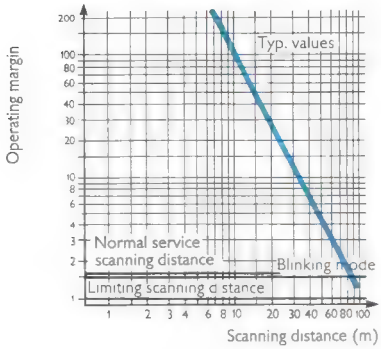
Signal strength indicator and viewfinder facilitate adjustment.

Scanning Distance

100 m

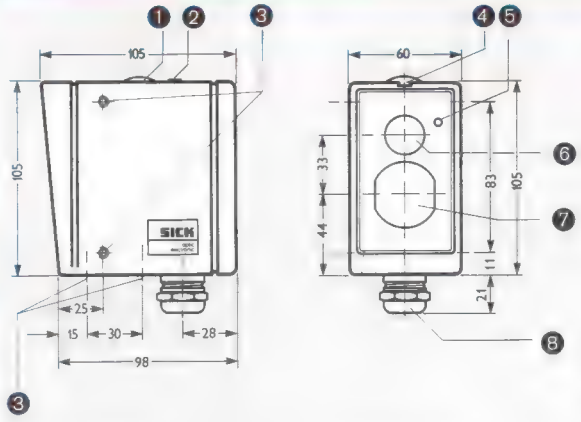
Features

- Optical alignment facility
- Output to signal dirt build-up (N and P versions)
- Status indicator in terminal chamber
- Supply connections reverse-polarity protected
- Adjustable sensitivity
- Transistor outputs NPN and PNP, short-circuit protected
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location
- No false triggering on power-up
- Wide supply-voltage ranges for direct and universal voltage
- Lens heater
- Light- and dark-switching
- Glass sealing disk, 5 mm thick
- Metal housing



WS 45 / WE 45

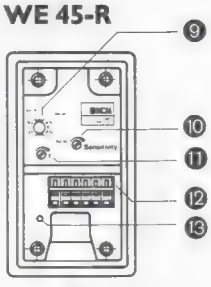
Dimensions in mm



For cable receptacle (accessories), right angle, Part No. 6006 613, and straight, Part No. 6006 612, see page 150.

WE 45-N/P

WE 45-R

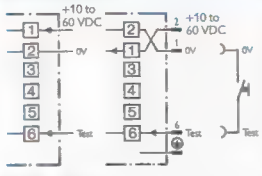


1. Eyepiece for alignment device
2. Signal strength indicator at top
3. Threaded mounting holes M 6, 8 mm deep
4. Alignment sight
5. Signal strength indicator
6. Viewfinder objective lens
7. Light source (WS), light receiver (WE)
8. PG 13.5 cable gland (for cable diameter 7 to 15 mm)
9. Time delay switch, on relay version with light/dark selection
10. Sensitivity control
11. Time delay control
12. Terminal strip
13. Status indicator

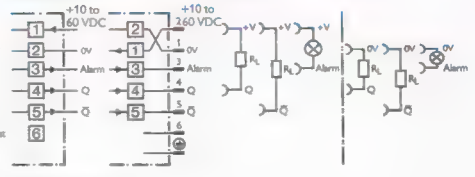
For mounting bracket (accessories), Part No. 2011 480, see page 147.
For ball-joint bracket (accessories), Part No. 2011 436, see page 147.
For dust shield (accessories), Part No. 2011 432, see page 152.
For snow shield (accessories), Part No. 2011 431, see page 152.
For cooling plate (accessories), Part No. 2011 435, see page 152.

Connection Diagram

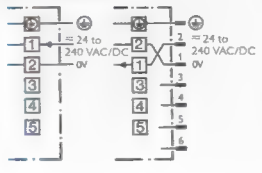
WS 45-D



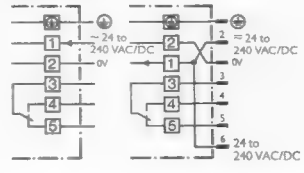
WE 45 **-N** **-P**



WS 45-U



WE 45-R



WS 45 / WE 45
Through-beam Photoelectric Switch

WS 45 / WE 45	WS 45 Sender		WE 45 Receiver		
Model	**-D 260** [1]	**-U 260**	**-N 260** [1]	**-P 260** [1]	**-R 260**
Part No.			1010984	1010985	1010995
Type of connection	terminal chamber				
Mountig bracket, Part No.	2011480				
Ball-joint bracket, Part No.	2011436				
Scanning distance	100 m				
Supply voltage V_S	10 to 60 VDC [2]	24 to 240 VAC/DC [3]	10 to 60 VDC [2]		24 to 240 VAC/DC [3]
Current consumption/power consumption [4]	≦50/250 mA	<3 VA/6 VA	≦50 mA/≦250 mA		≦3 VA/≦6 VA
Ripple [5]	≦5 V_{pp}	–	≦5 V_{pp}		–
Light source	LED, infrared, modulated, 100,000 h [6]				
Light spot diameter	approx. 4 m at a distance of 100 m		–		
Angle of dispersion/angle of reception	approx. 2.5°		approx. 1.2°		
Switching outputs	–		NPN, Q and $\overline{Q}$	PNP, Q and $\overline{Q}$	SPDT, isolated [7]
Signal voltage HIGH/switching voltage max.	–		approx. V_S	V_S – (≦2 V)	250/120 V (AC/DC)
Signal voltage LOW [8]/switching current max.	–		≦2 V	approx. 0 V	4/2 A (AC/DC)
Output current max./switching power max.	–		200 mA		750VA/120W (AC/DC)
Response time [9]; switching frequency max. [10]	–		≦500 µs; 1000/s		≦10 ms; 10/s
Time delay	–		switch-selectable		
Switch position t_0	–		no time delay		
Switch position t_1 or t_3	–		delay from leading edge of object		
Switch position t_2 or t_4	–		delay from trailing edge of object		
Time delays	–		0.015 to 0.3 s or 0.5 to 12 s		0.5 to 12 s
Adjustable with	–		270°-potentiometer		
Alarm output	–		dirt build-up signalling		–
Output/output current max.	–		open collector/100 mA		–
"Sufficient" light received (signal reserve ≧50%)	–		output LOW	output HIGH	–
"Insufficient" light received	–		switching periodically at 5 Hz		–
Test input	light source deactivated				
Internal resistance	≧22 kΩ				
Enclosure rating	IP 67; with plug IP 65				
Circuit protection [11]	A	–	A, B, C		–
Ambient operating temperature	–25 to +55 °C no cooling, to +120 °C with cooling				
Storage temperature	–40 to +70 °C				
Weight	approx. 800 g				

1) Special versions: see selection table
2) Limit values
3) +10%, –25%
4) Without/with lens heater
5) Must be within V_S tolerances
6) At room temperature = +25 °C
7) Provide suitable arc suppression with inductive or capacitive loads
8) At room temperature = +25 °C and output current of 100 mA
9) With resistive load
10) With light/dark time ratio of 1:1; no time delay
11) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ and "alarm" short circuit protected
C = interference suppression

Available on Request:

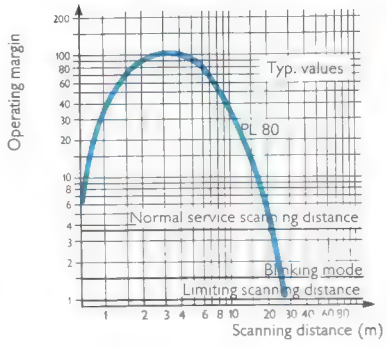
with lens heater		with 7-pin plug, to DIN 43 651		with lens heater and 7-pin plug, to DIN 43 651	
WS 45-D 250	Part No. 1009731	WS 45-D 660	Part No. 1009732	WS 45-D 650	Part No. 1009735
WS 45-U 250	Part No. 1009730	WS 45-U 660	Part No. 1009733	WS 45-U 650	Part No. 1009734
WE 45-N 250	Part No. 1009723	WE 45-N 660	Part No. 1009724	WE 45-N 650	Part No. 1009729
WE 45-P 250	Part No. 1009722	WE 45-P 660	Part No. 1009725	WE 45-P 650	Part No. 1009728
WE 45-R 250	Part No. 1009721	WE 45-R 660	Part No. 1009726	WE 45-R 650	Part No. 1009727

Scanning Distance

45 m

Features

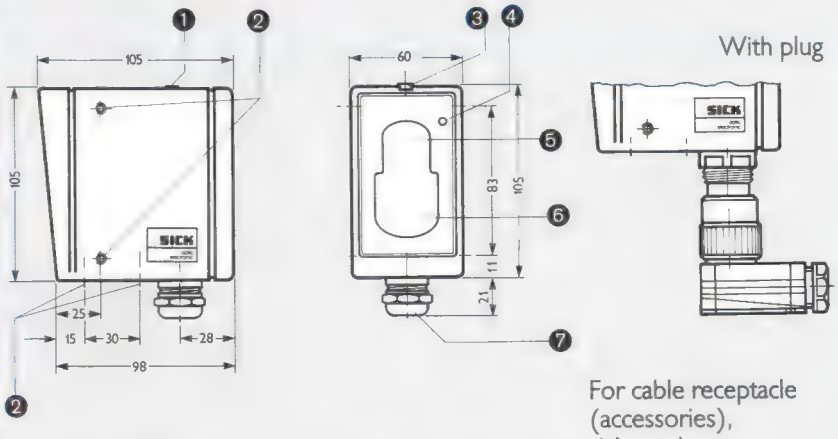
- Output to signal dirt build-up (N and P versions)
- Polarizing filter
- Status indicator in terminal chamber
- Supply connections reverse-polarity protected
- Light- and dark-switching by complementary switching outputs Q and $\overline{Q}$ (WL 45-N, -P), or switch-selectable (WL 45-R)
- Adjustable sensitivity
- Transistor outputs short circuit protected, NPN or PNP
- Insensitive to ambient light
- Switch-selectable time delay
- Test input (only WL 45-N/P)
- Wide supply voltage ranges for direct and alternating voltage
- No false triggering on power-up
- Glass sealing disk, 5 mm thick
- Metal housing



WL 45-N, -P, -R 260

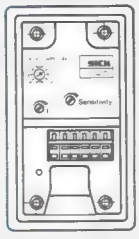
WL 45-N 260, -P 260, -R 260

Dimensions in mm

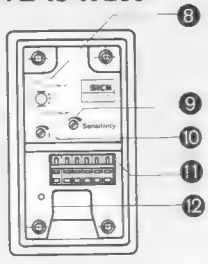


For cable receptacle (accessories), right angle, Part No. 6006613, and straight, Part No. 6006612, see page 150.

WL 45-N 260, -P 260,



WL 45-R 260

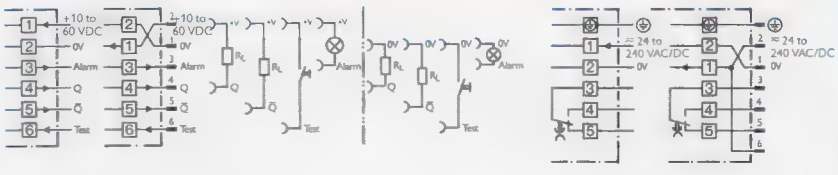


❶ Signal strength indicator at top
❷ Threaded mounting holes M6, 8 mm deep
❸ Alignment sight
❹ Signal strength indicator at front
❺ Light source
❻ Light receiver
❼ PG 13.5 cable gland (for cable diameter 7 to 15 mm)
❽ Time delay switch, on relay version with light/dark selection
❾ Sensitivity control
❿ Time delay control
⓫ Terminal strip
⓬ Status indicator

For mounting bracket (accessories), Part No. 2011480, see page 147.
For ball-joint bracket (accessories), Part No. 2011436, see page 147.
For dust shield (accessories), Part No. 2011432, see page 152.
For snow shield (accessories), Part No. 2011431, see page 152.
For cooling plate (accessories), Part No. 2011435, see page 152.
For reflectors (accessories), see page 144.

Connection Diagram

WL 45 -N 260 -P 260 -R 260



WL 45
Photoelectric Reflex Switch

WL 45	-N 250	-P 250	-R 250
Part No.	1008669	1008668	1008562
Type of connection	terminal chamber		
Mounting bracket, Part No.	2011480		
Ball-joint bracket, Part No.	2011436		
Scanning range			
With OP 60-∞[1]) reflector	Part No. 1000141	1 to 45 m	
With four PL 80 reflectors	4 x Part No. 1003865	0 to 28 m	
With PL 80 reflector	Part No. 1003865	0 to 20 m	
With C 110 reflector	Part No. 5304549	0.1 to 15 m	
With PL 50 reflector	Part No. 1000132	0 to 11 m	
With PL 30 reflector	Part No. 1002314	0 to 9 m	
With "Diamond Grade" reflective tape	Part No. 4019634	0.3 to 8 m (min. area: 80 x 80 mm²)	
Supply voltage V_S	10 to 60 VDC[2])		24 to 240 VAC/DC[3])
Current consumpt./power consumpt.[4])	≦50 mA/≦250 mA		≦3 VA/≦6 VA
Ripple max.[5])	5 V_{pp}		–
Light source	LED, visible red light, modulated, average service life 100,000 h[6])		
Light spot diameter	approx. 230 mm at a distance of 16 m		
Switching outputs	NPN, Q and $\overline{Q}$	PNP, Q and $\overline{Q}$	SPDT, isolated[7])
Signal voltage HIGH/switch. voltage max.	approx. V_S	V_S – (≦1.5)	250/120 V (AC/DC)
Signal voltage LOW/switch. current max.	≦1.5 V	approx. 0 V	4/2 A (AC/DC)
Output current max./switch. power max.	200 mA		750 VA/120 W (AC/DC)
Response time[8]); switching frequency[9])	≦1.2 ms; max. 400/s		≦20 ms; max. 10/s
Time delay	switch-selectable		
Switch position t_0	no time delay		
Switch position t_1 (or t_3)	delay from leading edge of object		
Switch position t_2 (or t_4)	delay from trailing edge of object		
Time delays	0.015 to 0.3 s or 0.5 to 12 s 0.5 to 12 s		0.5 to 12 s
Adjustable with	270°-potentiometer		
Alarm output	dirt build-up signalling		
Output/output current max.	open collector/100 mA		–
"Sufficient" light received (sign.res. ≧50%)	output LOW	output HIGH (+V_S–1.5V)	–
"Insufficient" light received	switching periodically at approx. 5/s		–
Test input	light source deactivated		–
Internal resistance	≧33 kΩ		
Enclosure rating	IP 67; with plug IP 65		
Circuit protection[10])	A, B, C		–
Ambient operating temperature	–25 to +55 °C no cooling, to +120 °C with cooling		
Storage temperature	–40 to +70 °C		
Weight	approx. 800 g		

1) Position-dependent: action of reflector may have to be optimized by turning it
2) Limit values
3) +10%, –25%
4) Without/with lens heater
5) Must be within V_S tolerances
6) At room temperature = +25 °C
7) Provide suitable arc suppression with inductive or capacitive loads
8) With resistive load; no time delay
9) With light/dark time ratio of 1:1, no time delay
10) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression

Available on Request:

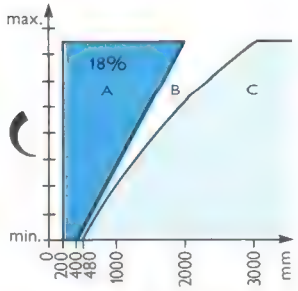
with lens heater		with 7-pin plug, to DIN 43651		with lens heater and 7-pin plug, to DIN 43651	
WL 45-N 250	Part No. 1008839	WL 45-N 660	Part No. 1008830	WL 45-N 650	Part No. 1008838
WL 45-P 250	Part No. 1008840	WL 45-P 660	Part No. 1008831	WL 45-P 650	Part No. 1008837
WL 45-R 250	Part No. 1008841	WL 45-R 660	Part No. 1008832	WL 45-R 650	Part No. 1008836

Adjustable Scanning Distance

400 to 2000 mm

Features

- Continuously adjustable scanning distance
- Background suppression
- Status indicator in terminal chamber
- Supply connections reverse-polarity protected
- Light- and dark-switching
- Transistor outputs short circuit protected
- Insensitive to ambient light
- Switch-selectable time delay
- Test input (not on WT 45-R)
- No false triggering on power-up
- Wide supply voltage ranges for direct and universal voltage
- Glass sealing disk, 5 mm thick
- Metal housing

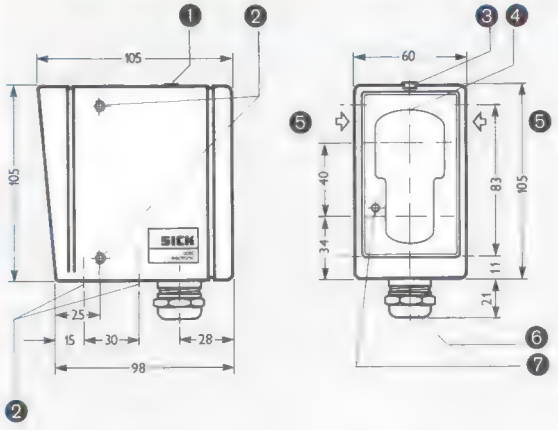


Background suppression
A = scanning range
B = background suppression range
C = background

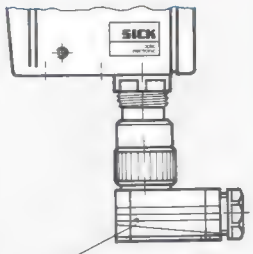
WT 45-N, -P, -R 260

WT 45-N 260, -P 260 **-R 260**

Dimensions in mm

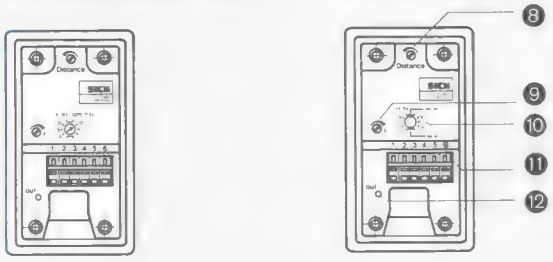


With plug



For cable receptacle (accessories), right angle, Part No. 6006613, and straight, Part No. 6006612, see page 150.

WT 45-N 260, -P 260 **WT 45-R 260**

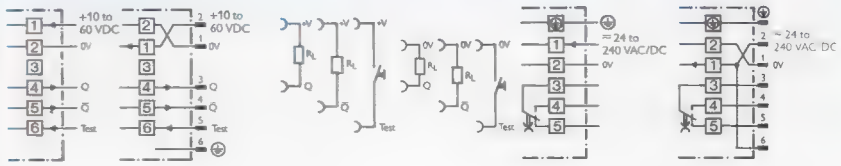


❶ Signal strength indicator at top
❷ Threaded mounting holes M6, 8 mm deep
❸ Alignment sight
❹ Center of optical axis
❺ Relative direction of movement of object being scanned
❻ PG 13.5 cable gland (for cable diameter 7 to 15 mm)
❼ Signal strength indicator at front
❽ Scanning distance control
❾ Time delay control 0.5 to 12 s
❿ Time delay switch, on relay version with light/dark selection
⓫ Terminal strip
⓬ Status indicator

For mounting bracket (accessories), Part No. 2011480, see page 147.
For ball-joint bracket (accessories), Part No. 2011436, see page 147.
For dust shield (accessories), Part No. 2011432, see page 152.
For snow shield (accessories), Part No. 2011431, see page 152.
For cooling plate (accessories), Part No. 2011435, see page 152.

Connection Diagram

WT 45
-250 -650 -N 250 -P 250 -R 250 -R 650
-260 -660 -N 260 -P 260 -R 260 -R 660



Photoelectric Proximity Switch

WT 45	-N 260	-P 260	-R 260
Part No.	1009109	1009108	1009107
Type of connection	terminal chamber		
Mounting bracket, Part No.	2011480		
Ball-joint bracket, Part No.	2011436		
Scanning distance, adjustable	400 to 2000 mm		
Scanning range[1]) w/ background suppr.	200 to 400 mm / 200 to 2000 mm		
Supply voltage V_S	10 to 60 VDC[2])		24 to 240 VAC/DC[3])
Current consumpt./power consumption[4])	≦50 mA/≦250 mA		≦3 VA/≦6 VA
Ripple[5])	≦5 V_{pp}		–
Light source	LED, infrared, modulated, average service life 100,000 h[6])		
Light spot diameter	approx. 35 mm at a distance of 2000 mm		
Switching outputs	NPN, Q and $\overline{Q}$	PNP, Q and $\overline{Q}$	SPDT, isolated[7])
Signal voltage HIGH/switch. voltage max.	approx. V_S	V_S – (≦2 V)	250/120 V (AC/DC)
Signal voltage LOW/switch. current max.	≦2 V	approx. 0 V	4/2 A (AC/DC)
Output current max./switch. power max.	200 mA		750/120 VA (AC/DC)
Response time[8]); switching frequency[9])	max. 6 ms; max. 50/s		≦20 ms; max. 10/s
Time delay[10])	switch-selectable		
Switch position t_0	no time delay		
Switch position t_1 or t_3	delay from trailing edge of object		
Switch position t_2 or t_4	delay from leading edge of object		
Time delays	0.015 to 0.3 s or 0.5 to 12 s		0.5 to 12 s
Adjustable with	270°-potentiometer		
Test input	light source deactivated		–
Internal resistance	≧33 kΩ		
Enclosure rating	IP 67; with plug IP 65		
Circuit protection[11])	A, B, C		–
Ambient operating temperature max.	–25 to +55 °C no cooling, +120 °C with cooling		
Storage temperature	–40 to +70 °C		
Weight	approx. 750 g		

1) Material with 18% reflectance (based on white standard, to DIN 5033)
2) Limit values
3) +10%, –25%
4) Without/with lens heater
5) Must be within V_S tolerances
6) At room temperature = +25 °C
7) Provide suitable arc suppression with inductive or capacitive loads
8) With resistive load; no time delay
9) With light/dark time ratio of 1:1; no time delay
10) Adjustable in terminal chamber
11) A = supply connections reverse-polarity protected
B = outputs Q and $\overline{Q}$ short circuit protected
C = interference suppression

Available on Request:

with lens heater		with 7-pin plug, to DIN 43 651		with lens heater and 7-pin plug, to DIN 43 651	
WT 45-N 250	Part No. 1009116	WT 45-N 660	Part No. 1009110	WT 45-N 650	Part No. 1009115
WT 45-P 250	Part No. 1009117	WT 45-P 660	Part No. 1009111	WT 45-P 650	Part No. 1009114
WT 45-R 250	Part No. 1009118	WT 45-R 660	Part No. 1009112	WT 45-R 650	Part No. 1009113


RUSTICA

W 32-Series
Photoelectric Proximity Switches

WT 32

100 to
2000 mm

Photoelectric proximity switches in glassfiber-reinforced plastic housing. With sensitivity control and signal strength indicator.

With terminal chamber (cable gland PG 11) conforming to IP 67; also available with plug, to IP 65. Supply voltage range 10 to 30 V direct voltage or 24 to 240 V universal voltage.

Output for external dirt build up monitoring and test input to test sensor on demand from remote location (direct-voltage version).

Outputs possible with NPN, PNP and B configurations.

Behind back cover: selector switch for time delay; light/dark selector; time-delay and sensitivity controls.

Terminal chamber on models with and without plug.

Scanning Range

100 to 2000 mm

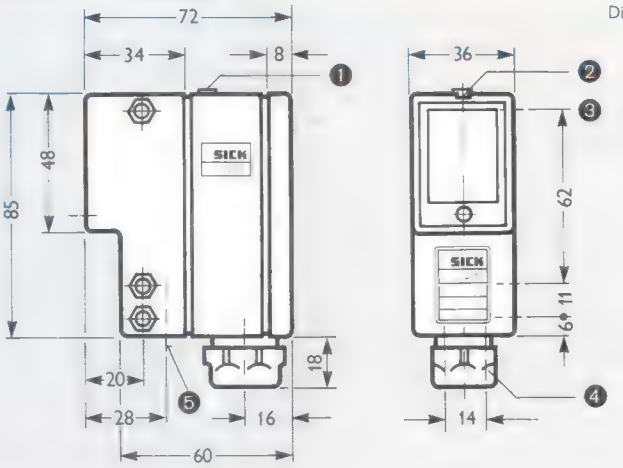
Features

- Blinking LED signal strength indicator to show dirt build-up on optics
- Supply connections reverse-polarity protected
- Choice of light- or dark-switching
- Adjustable scanning distance
- Transistor outputs short circuit protected, PNP or NPN
- Insensitive to ambient light
- Switch-selectable time delay
- Test input to test sensor on demand from remote location (not on WT 32-R)
- No false triggering on power-up
- Direct-voltage and alternating voltage supply (WT 32-R)

WT 32

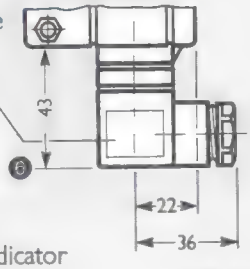
-R 230

Dimensions in mm



-B 330

For cable receptacle (accessories), Part No. 8005 698, see page 150.



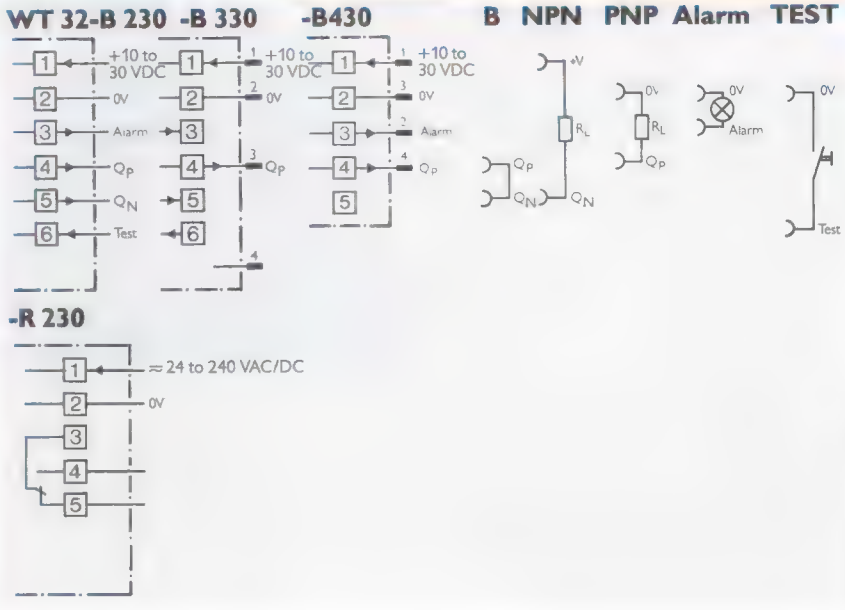
-B 430

For cable receptacle (accessories), Part No. 6007 302, Part No. 6 007 303 see page 150.

❶ Signal strength indicator
❷ Alignment sight
❸ Mounting holes through enclosure, recessed on both sides for M5 hex nut
❹ PG11 cable gland (for cable diam. 5 to 12 mm)
❺ Threaded mounting holes M5, 5.5 mm deep

For mounting bracket (accessories), Part No. 2005 806, see page 147.

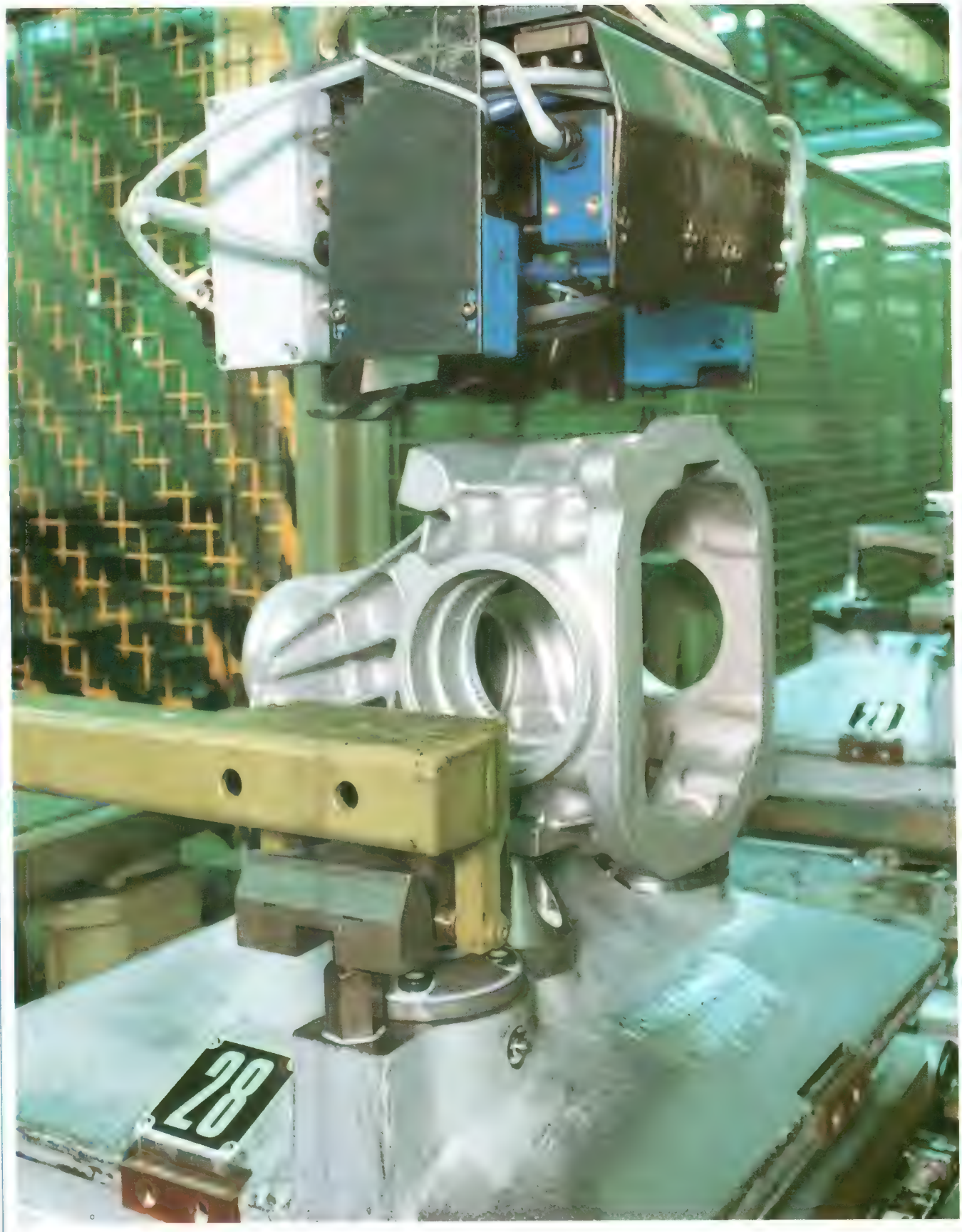
Connection Diagram



WT 32
Photoelectric Proximity Switch

WT 32	-B 230	-B 430	-B 330	-R 230
Part No.	1007397	1011110	1007411	1007413
Type of connection (T/P)[1]	T	P, 4-pin	P, 3-pin	T
Cable receptacle, Part No.	–	6006612 6006613	6005698	–
Mounting bracket, Part No.	2005806			
Scanning range[2]	100 to 2000 mm			
Supply voltage V_S	10 to 30 VDC[3]			24 to 240 VAC/DC (+10%, –25%)
Current consumption/power consumption	≦40 mA			<2 VA
Ripple max.[4]	5 V_{pp}			–
Light source	LED, infrared, modulated, average service life 100,000 h[5]			
Light spot diameter	approx. 60 mm at a distance of 2 m			
Light receiver switching mode	light- or dark-switching, switch-selectable			
Max. scanning distance	adjustable (in the terminal chamber)			
Signal strength indicator	LED			
Switching outputs	PNP/NPN		PNP	SPDT, electrically isolated[6]
Signal voltage HIGH/switching volt. max.	V_S – (≦1.5)[7]			250 VAC
Signal volt. LOW/switching current max.	≦1.5 V[8]			3 A
Output current max./switch. power max.	200 mA			500 VA
Response time[9]); switching frequency[10]	≦5.6 ms; max. 80/s[11]			<20 ms; max. 10/s
Time delay[5]	switch-selectable (in the terminal chamber)			
Switch position 0/t	no time delay/time delay active			
Switch position 1/2	delay from leading edge of object/delay from trailing edge of object			
Time delay	0.02 to 1 s			0.5 to 12 s
Adjustable with	270°-potentiometer			
Alarm output	dirt build-up signalling		–	
PNP output	open collector		–	
"Sufficient" light received[12]	output HIGH (+V_S – 1.5 V)		–	
"Insufficient" light received	switch. periodic. to V_S at 5/s		–	
Test input	sender deact.	–	–	
Internal resistance	≧15 kΩ	–	–	
Sender "active"	+V_S or not con.	–	–	
Sender "inactive"	0 V	–	–	
Enclosure rating	IP 67		IP 65	IP 67
Circuit protection[13]	A, B, C			–
Ambient operating temperature	–25 to +55 °C			
Storage temperature	–40 to +70 °C			
Weight	165 g			

1) T = terminal chamber; P = plug connector
2) Based on white standard, to DIN 5033
3) Limit values
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) Provide suitable arc suppression with inductive or capacitive loads
7) NPN output: +V_S
8) PNP output: +0.1 V
9) With resistive load
10) With light/dark time ratio of 1:1
11) No time delay
12) Signal reserve ≧50%
13) A = supply connections reverse-polarity protected
B = outputs Q_P and $\overline{Q}_N$ short circuit protected
C = interference suppression



 WT 30 photoelectric proximity switches control robot for precise positioning of gaerbox cases

WT 30

300 mm

Photoelectric proximity switches in glassfiber-reinforced plastic housing. With status indicator. Detects materials with extremely low reflectance.

Terminal chamber. Enclosure rating IP 67. Supply voltage range 10 to 30 V.

Built-in background suppression beginning at end of specified scanning range.

Outputs in NPN and PNP configuration, with and without current limitation; B configuration also possible.

Terminal chamber with enclosure rating IP 67 (dusttight, watertight).

Status indicator and alignment sight.

Scanning Distance

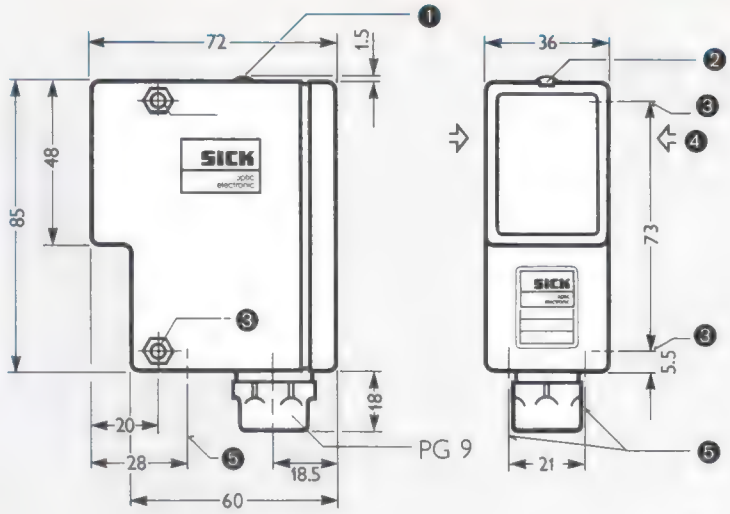
300 mm

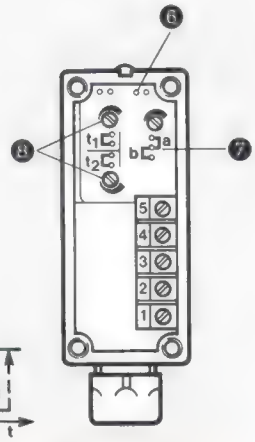
Features

- Detects materials with extremely low reflectance
- Background suppression
- Supply connections reverse-polarity protected
- Light- or dark-switching
- Status indicator
- Complementary switching outputs
- Separate output with current limitation
- Switch-selectable time delays t_1 and t_2
- Separately adjustable time delays
- Glassfiber-reinforced plastic housing

WT 30

Dimensions in mm

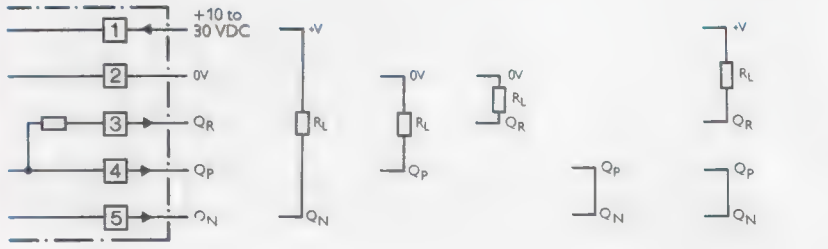




1. Status indicator
2. Alignment sight
3. Mounting holes through enclosure, recessed on both sides for M5 hex nut
4. Directions of movement of scanning plane
5. Threaded mounting holes M5, 5.5 mm deep
6. Storage for unused timer links
7. Light/dark energized settings a/b
8. Timer adjustments

For mounting bracket (accessories), Part No. 2005806, see page 147.

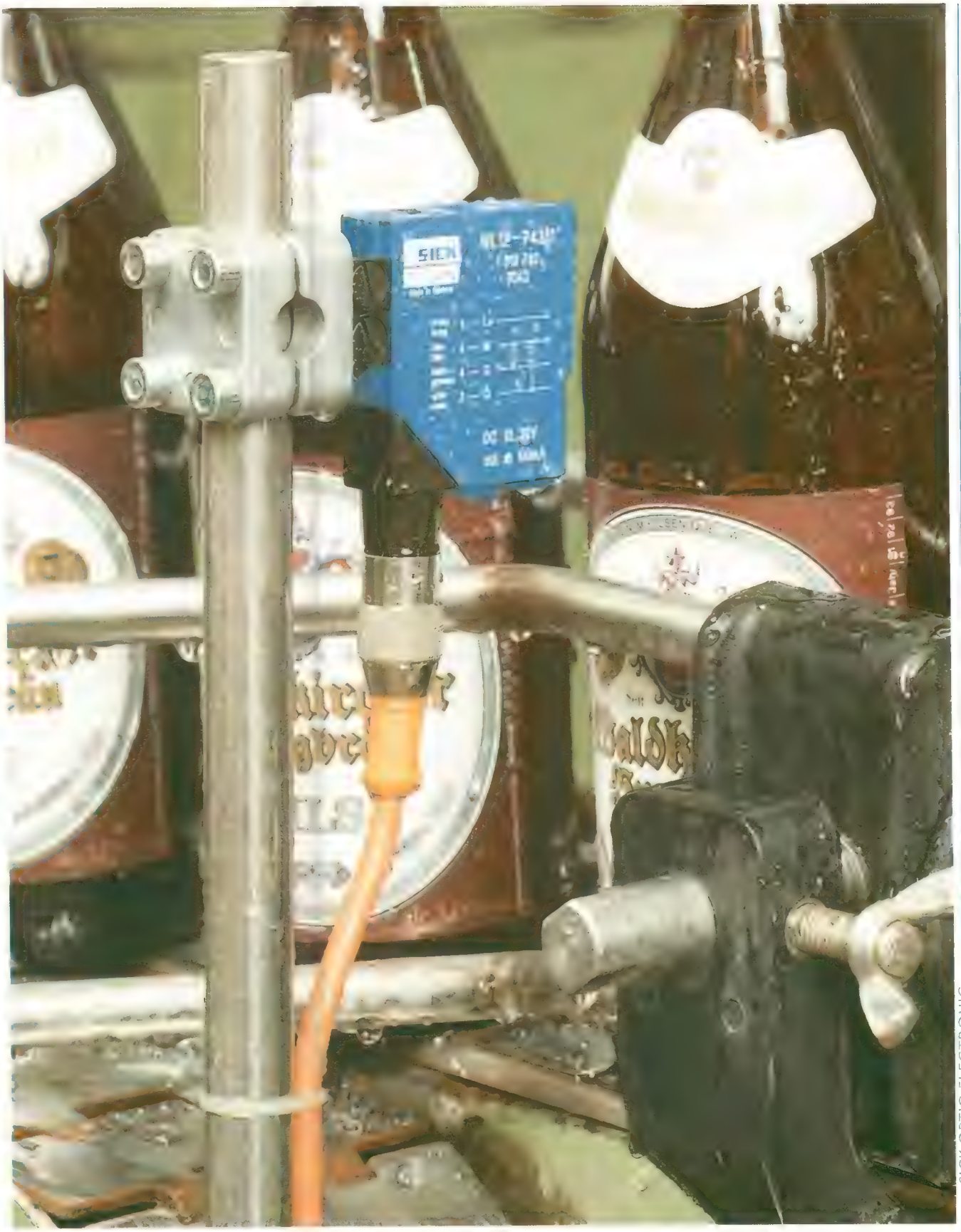
Connection Diagram



WT 30
Photoelectric Proximity Switch

WT 30	-01	-11	-21	-02	-12	-22
Part No.	1004179	1004489	1004585	1004180	1004490	1004586
Type of connection	terminal chamber					
Mounting bracket, Part No.	2005806					
Scanning range	30 to 305 mm	15 to 100 mm	25 to 200 mm	30 to 305 mm	15 to 100 mm	25 to 200 mm
Tolerance on max. scanning range	±10 mm	±4 mm	±6 mm	±10 mm	±4 mm	±6 mm
Black/white scanning-distance difference	±5 mm	±2 mm	±3 mm	±5 mm	±2 mm	±3 mm
Supply voltage V_S	10 to 30 VDC[1])					
Current consumption (no load)	≦80 mA					
Ripple[2])	≦10 V_{pp}					
Light source	LED, infrared, modulated, average service life 100,000 h[3])					
Light spot diameter	11 mm	3.5 mm	11 mm	11 mm	3.5 mm	11 mm
At a distance of	300 mm	100 mm	200 mm	300 mm	100 mm	200 mm
Light receiver switching mode[4])	light- or dark-switching					
Signal strength indicator	LED					
Switching outputs[5])	NPN, PNP, B					
Signal voltage HIGH[6])	V_S − (≦1.5)					
Signal voltage LOW[7])	<1.0 V					
Output current max.	250 mA					
Response time[8]); switching frequency[9])	<15 ms; max. 30/s			<15 ms; max. 30/s[10])		
Time delay[4])						
Jumper t_1 inserted	–			delayed LOW-HIGH transition		
Jumper t_2 inserted	–			delayed HIGH-LOW transition		
Time delays	–			0.04 to 12 s		
Adjustable with	–			20 turn helipot		
Enclosure rating	IP 67					
Ambient operating temperature	−25 to +55 °C					
Storage temperature	−40 to +80 °C					
Weight	approx. 210 g					

1) Limit values
2) Must be within V_S tolerances
3) At room temperature = +25 °C
4) Pluggable or adjustable in terminal chamber
5) Can be selected using terminal connections
6) NPN output: +V_S
7) PNP output: approx. 0 V
8) With resistive load
9) With light/dark time ratio of 1:1
10) No time delay


SICK

W 12 Series
Photoelectric Switches

WS 12 / WE 12

WL 12

WT 12

Photoelectric switches in solid metal housing, including WT 12 photoelectric proximity switches with infinitely adjustable scanning distances and optional background or foreground suppression and WL 12 photoelectric switches with polarizing filters.

WS/WE 12 through-beam photoelectric switches, with test input for monitoring its operation.

Signal strength indicator (blinking) to show misalignment or dirt buildup on the optics, providing forewarning of failure.

Available with plug or permanently connected cable.

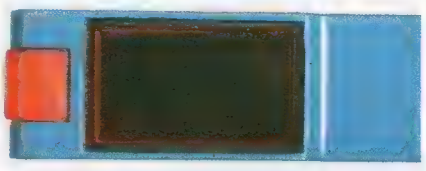
Supply voltage 10 to 30 V.

Insensitive to ambient light due to pulse modulation.

Complementary switching outputs for light or dark-switching, with short circuit protection, in NPN or PNP versions.

Signal strength indicator clearly visible from front and above.

Available as through-beam photoelectric switch, photoelectric reflex and proximity switch, and as contrast sensor.



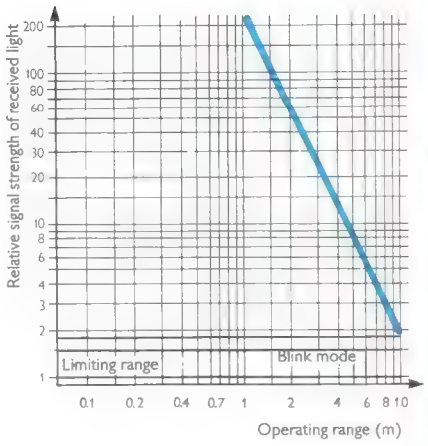
Behind the precision optics of the WL 12: polarizing filters, allowing recognition of objects with reflective surfaces too.

Scanning range

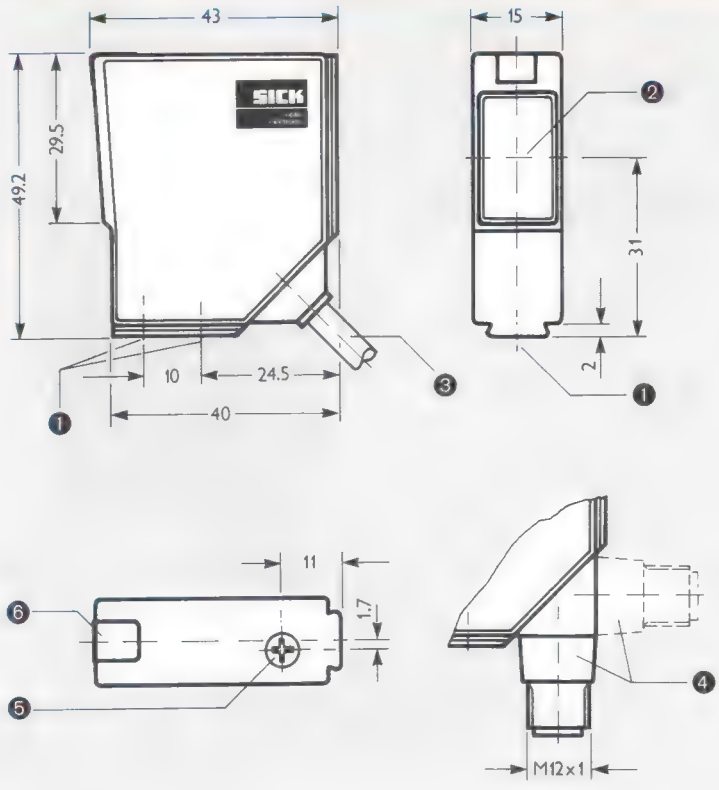
0 to 10 m

Features

- Blinking signal strength indicator to show misalignment and provide forewarning of failure
- Supply connections reverse-polarity protected
- Power indicator for light sender, signal strength indicator for light receiver
- Complementary switching outputs Q and $\overline{Q}$
- Switching outputs short circuit protected
- Insensitive to ambient light
- Test input for testing device and system
- No false triggering on power-up
- Solid metal housing, zinc diecasting or stainless steel
- Adjustable sensitivity



WS 12 / WE 12



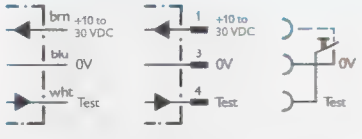
1. M4 threaded mounting hole, 4 mm deep
2. Centre of optical axis
3. Connecting cable, 2 m long
4. 4-pin plug
5. Sensitivity control
6. Signal strength indicator, power indicator

Mounting brackets and cable receptacles: see Accessories (page 147, 150)

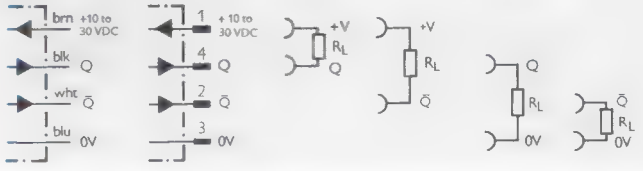
Connection diagram

WS 12-...

brn	blu	wht	blk
brown	blue	white	black



WE 12-... **-NPN** **-PNP**



WS 12/WE 12
through-beam photoelectric switch

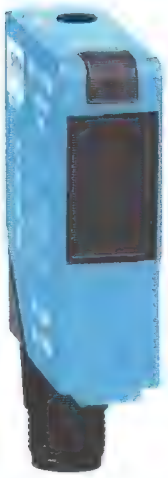
Model	WS 12/WE 12	-N	-P
Scanning range		10 m	
Supply voltage V_S		10 to 30 VDC (limit values)	
Current consumption (no load)		≦ 40 mA	
Ripple[1]		5 V_{pp}	
Light sender		IR LED, modulated, average life 100 000 h[2]	
Angle of dispersion		approx. 1.5°	
Light-spot diameter		130 mm at distance of 5 m	
Transistor outputs Q and $\overline{Q}$		NPN	PNP
Signal voltage HIGH		approx. V_S	V_S – (≦ 1.8 V)[3]
Signal voltage LOW[3]		≦ 1.8 V	0 V
Output current I_A max.		100 mA	
Response time[4]; Switching freq., max.[5]		≦ 500 µs; 1000/s	
Test input		Light source disabled	
Internal resistance		≧ 22 kΩ	
Enclosure rating		IP 67	
Protection circuits[6]		A, B, C	
Ambient operating temp.[7]		–40 to +55 °C	
Storage temperature[7]		–40 to +75 °C	
Weight (sender + receiver)		with plug 260 g; with connecting cable 400 g	

1) Must remain within V_S tolerances
2) At room temperature = +25 °C
3) At room temperature = +25 °C and 100 mA output current
4) With resistive load
5) With light/dark ratio of 1:1

6) A = V_S connections reverse-polarity protected
B = Outputs Q and $\overline{Q}$ short circuit protected
C = Interference suppression
7) Do not deform connecting cables at temperatures below 0 °C; do not operate adjusting knob at temperatures below –25 °C

Selection table

Housing	Connector cable (2 m)		Plug (4-pin, below)		Plug (4-pin, rear)	
	Model	Part no.	Model	Part no.	Model	Part no.
Standard housing	N 1321 P 1321	1010819 1010820	N 4381 **P 4381**	1010821 **1010822**	P 4371	1011028
Stainless steel	N 1322 P 1322	1011029 1011030	N 4382 **P 4382**	1011031 **1011032**	P 4372	1011034

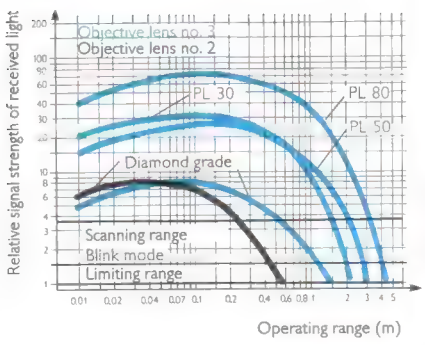


Scanning range

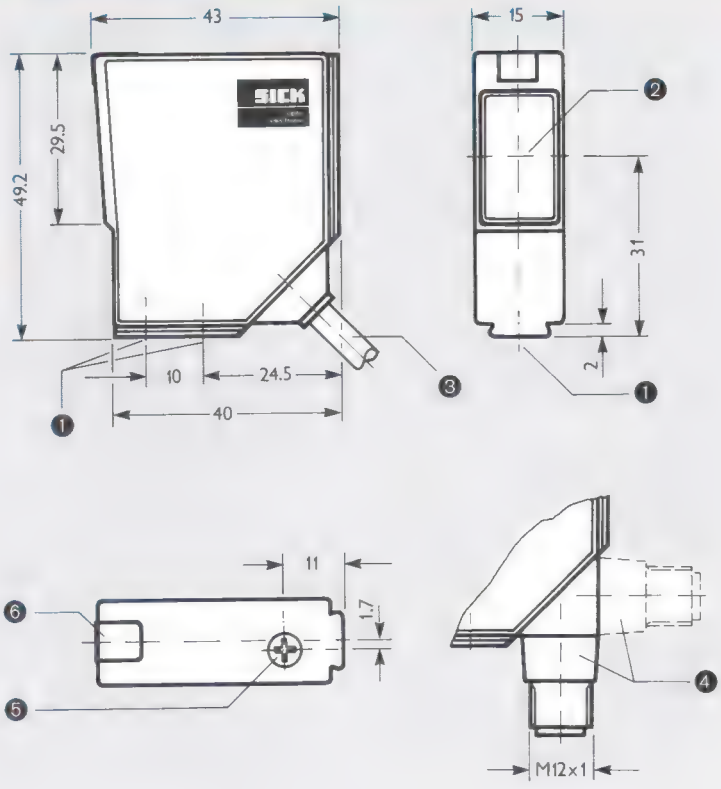
0 to 3 m

Features

- Polarizing filters, permitting detection of objects with reflective surfaces too
- Blinking signal strength indicator to show misalignment and provide forewarning of failure
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$
- Sensitivity control
- Switching outputs short circuit protected
- Insensitive to ambient light
- No false triggering on power-up
- Solid metal housing, zinc diecasting or stainless steel



WL 12

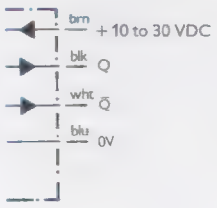


1. M4 threaded mounting hole, 4 mm deep
2. Centre of optical axis
3. Connecting cable, 2 m long
4. 4-pin plug
5. Sensitivity control
6. Signal strength indicator, power indicator

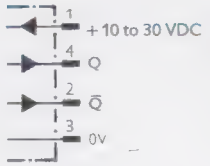
Mounting brackets, reflectors and cable receptacles: see Accessories (page 147, 150)

Connection diagram

WL 12-N1 -P 1



-N4 -P 4



-N NPN

-P PNP

brn	blk	wht	blu
brown	black	white	blue

WL 12
photoelectric reflex switch

WL 12	Objective lens no. 3		Objective lens no. 2	
	N	P	N	P
Scanning range[1]				
with PL 80 reflector	0 to 3 m		–	
with PL 50 reflector	0 to 2 m		–	
with PL 30 reflector	0 to 1.5 m		–	
with "Diamond Grade" reflective tape	0 to 0.5 m		0 to 200 mm	
Supply voltage V_S	10 – 30 VDC (limit values)			
Current consumption (no load)	≦ 40 mA			
Ripple[2]	≦ 5 V_{pp}			
Light sender	LED, visible red light, modulated, average life 100 000 h[3]			
Angle of dispersion	approx. 1.2°			
Lightspot diameter	60 mm at 3 m distance		≦ 2 mm at 90 mm dist.	
Transistor outputs Q and $\overline{Q}$	NPN	PNP	NPN	PNP
Signal voltage HIGH	V_S	V_S – (≦ 1.8 V)	V_S	V_S – (≦ 1.8 V)
Signal voltage LOW[4]	≦ 1.8 V	0 V	1.8 V	0 V
Output current I_A max.	100 mA			
Response time[5] Switching freq., max.[6]	≦ 500 µs; 1000/s			
Enclosure rating	IP 67			
Protection circuits[7]	A, B, C			
Ambient operating temp.[8]	–40 to +55 °C			
Storage temperature[8]	–40 to +75 °C			
Weight	with plug approx. 130 g; with connecting cable approx. 200 g			

1) Typical scanning range
2) Must remain within V_S tolerances
3) At room temperature = +25 °C
4) At room temperature = +25 °C and 100 mA output current
5) With resistive load
6) With light/dark ratio of 1:1
7) A = V_S connections reverse-polarity protected
   B = Q and $\overline{Q}$ outputs short circuit protected
   C = Interference suppression
8) Do not deform connecting cables at temperatures below 0 °C;
   do not operate adjusting knob at temperatures below –25 °C

Selection table

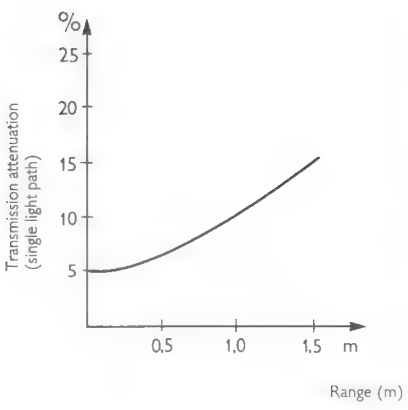
Housing	Objective lens	Connecting cable (2m)		Plug (4-pin, below)		Plug (4-pin, rear)	
		Model	Part no.	Model	Part no.	Model	Part no.
Standard housing	No. 3	N 1321	1010738	N 4381	1010739		
		P 1321	1010593	**P 4381**	**1010740**	P 4371	1011036
	No. 2	N 1221	1010804	N 4281	1010805		
		P 1221	1010594	**P 4281**	**1010748**	P 4271	1011038
Stainless steel	No. 3	N 1322	1011041	N 4382	1011043		
		P 1322	1011042	**P 4382**	**1011044**	P 4372	1011046
	No. 2	N 1222	1011047	N 4282	1011049		
		P 1222	1011048	**P 4282**	**1011050**	P 4272	1011052

Scanning range

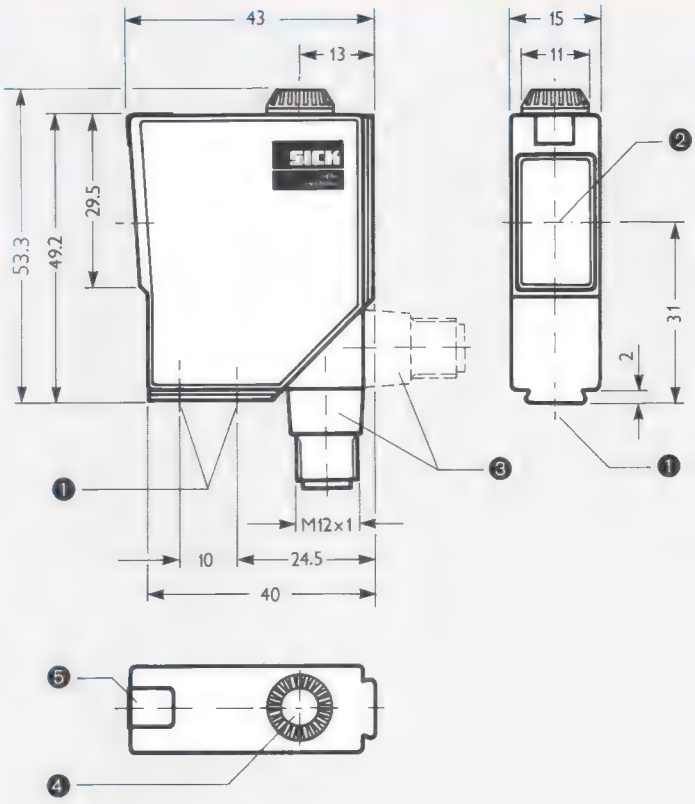
0 to 1.5 m

Features

- Detection of glass and transparent films
- LED light sender, visible red light
- Supply connections reverse-polarity protected
- No false triggering on power-up
- NPN and PNP switching output
- Insensitive to ambient light
- Polarizing filter, allowing detection of objects with reflective surfaces too
- Light or dark-switching, selection via control line
- Status indicator
- Switching frequency up to 1.3 kHz
- Solid metal housing, zinc diecasting or stainless steel
- Adjustable sensitivity



WL 12-B 5681

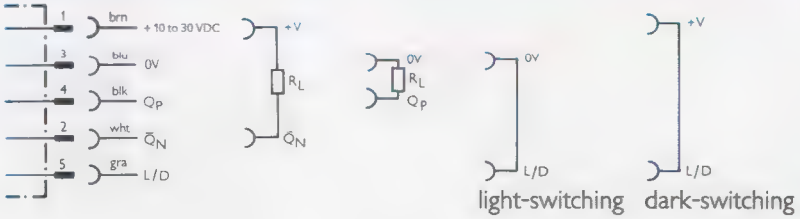


1. M4 threaded mounting hole, 4 mm deep
2. Centre of optical axis
3. 5-pin plug
4. Sensitivity control
5. Signal strength indicator

Mounting brackets and reflectors: see Accessories (page 147, 144, 150)

Connection diagram

WL 12-B 5681



gra	brn	blu	blk	wht
gray	brown	blue	black	white

WL 12-B 5681
photoelectric reflex switch with low switching hysteresis

WL 12-B 5681			
Scanning range			
with PL 80 reflector	0 to 1.5 m		
with PL 50 reflector	0 to 1.0 m		
with PL 30 reflector	0 to 1.0 m		
Supply voltage V_S	10 to 30 VDC (limit values)		
Current consumpt. (no load) at 24 VDC	≦ 25 mA		
Ripple[1]	≦ 5 V_{pp}		
Light sender	LED, visible red light, modulated, average life 100 000 h[2]		
Angle of dispersion	approx. 1.2°		
Lightspot diameter	approx. 30 mm at distance of 1.5 m		
Transistor outputs Q_P and Q_N		PNP	NPN
Output voltage HIGH		V_S – ≦ 2V	V_S
Output voltage LOW		0 V	≦ 2 V
Output current I_A max.		100 mA	100 mA
Operating mode	light- or dark-switching, L/D reversible via control line		
Control input L/D	0 V or unswitched: light-switching		
Control input L/D	V_S: dark-switching		
Response time, max.; Switching freq., max.[3]	360 µs; 1300/s		
Enclosure rating	IP 67		
Protection circuits[4]	A, B, C		
Ambient operating temp.	–25 to +55 °C		
Storage temperature	–25 to +75 °C		
Weight	approx. 130 g.		

1) Must remain within V_S tolerances
2) At room temperature = +25 °C
3) With light/dark ratio of 1:1
4) A = V_S connections reverse-polarity protected
B = Q_N and Q_P outputs short circuit protected
C = Interference suppression

Selection table

Housing	Plug, below		Plug, rear	
	Model	Part no.	Model	Part no.
Standard housing	B 5681	1011039	B 5671	1011040
Stainless steel	B 5682	1011053	B 5672	1011054

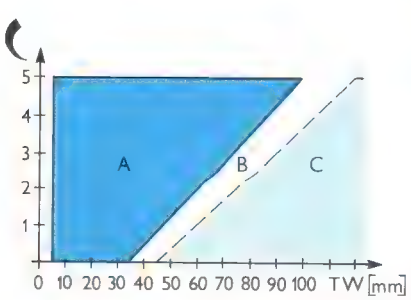
Accessories: 2 m connection cable with straight cable connector; part no. 6008899
2 m connection cable with right angle cable connector; part no. 6008900

Adjustable scanning range

35 to 100 mm

Features

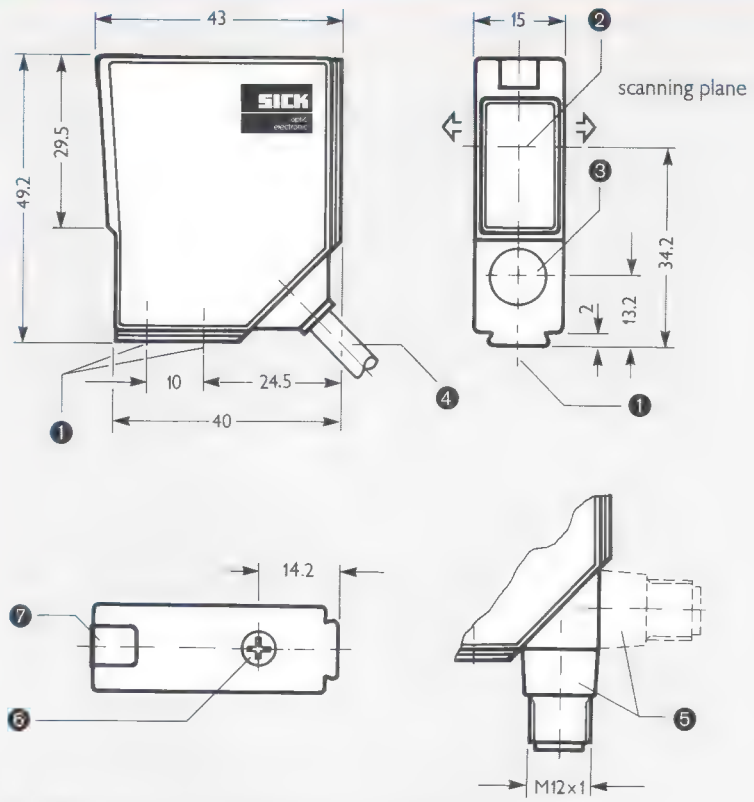
- Light sender: visible red light
- Infinitely adjustable scanning range
- Foreground suppression
- Blinking signal strength indicator to show misalignment and provide forewarning of failure
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$
- Switching outputs short circuit protected
- Insensitive to ambient light
- No false triggering on power-up
- Metal housing, zinc diecasting or stainless steel



Foreground blanking

A = Foreground blanking range
B = Scanning range R ≧ 9 %
C = Scanning range dependent on reflectivity of object to be sensed

WT 12

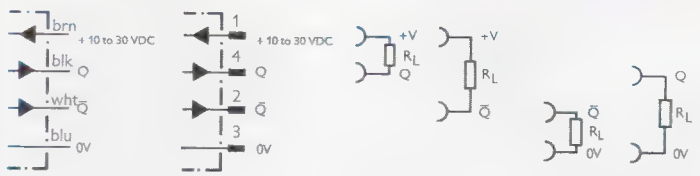


1. M4 threaded mounting hole, 4 mm deep
2. Centre of receiver optical axis
3. Centre of emittor optical axis
4. Connecting cable, 2 m long
5. 4-pin plug
6. Scanning range control
7. Signal strength indicator

Mounting brackets and cable receptacles: see Accessories (page 147, 150)

Connection diagram

WT 12-N1 -P 1 **-N4 -P 4** **-N NPN** **-P PNP**



brn	blk	wht	blu
brown	black	white	blue

WT 12
photoelectric proximity switch with foreground suppression

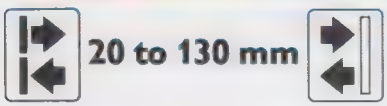
WT 12	N	P
Scanning range, adjustable[1]	35 to 100 mm	
Supply voltage V_S[2]	10 to 30 VDC	
Current consumption (no load)	≦ 40 mA	
Ripple[3]	≦ 5 V_{pp}	
Light sender	LED, visible red light, modulated, average life 100 000 h[4]	
Light-spot diameter	2 mm at distance of 60 mm	
Transistor outputs	NPN	PNP
Signal voltage HIGH	approx. V_S	V_S – (≦ 1.8 V)[5]
Signal voltage LOW[5]	≦ 1.8 V[5]	approx. 0 V
Output current I_A max.	≦ 100 mA	
Resp. time, max.[6]; Switching freq., max.[7]	500 µs; 1000/s	
Enclosure rating	IP 67 (dusttight, watertight)	
Protection circuits[8]	A, B, C	
Ambient operating temp.[9]	–40 to +55 °C	
Storage temperature[9]	–40 to +75 °C	
Weight	with plug approx. 130 g; with connecting cable approx. 200 g	

1) Object with 9 % reflection (based on white standard, to DIN 5033)
2) Limit value
3) Must remain within Vs tolerances
4) At room temperature = +25 °C
5) At room temperature = +25 °C and 100 mA output current
6) With resistive load
7) With light/dark ratio of 1:1
8) A = V_S connections reverse-polarity protected
   B = Q and $\overline{Q}$ outputs short circuit protected
   C = Interference suppression
9) Do not deform connecting cables at temperatures below 0 °C; do not operate adjusting knob at temperatures below –25 °C

Selection table

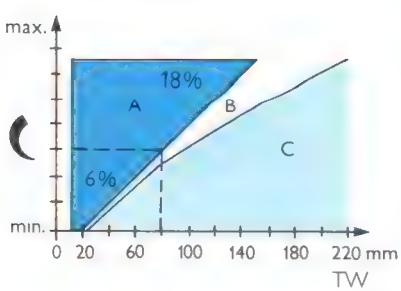
	Housing	Connection cable (2 m)		Plug (4-pin, below)		Plug (4-pin, rear)	
		Model	Part no.	Model	Part no.	Model	Part no.
with foreground suppression	Standard housing	N 1421	1010807	N 4481	1010811		
		P 1421	1010596	**P 4481**	**1010806**	P 4471	1011058
	Stainless steel	N 1422	1011068	N 4482	1011070		
		P 1422	1011069	**P 4482**	**1011071**	P 4472	1011073

Adjustable scanning range



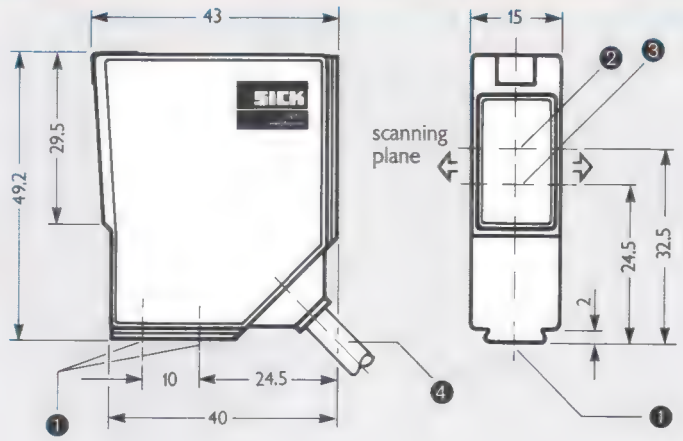
Features

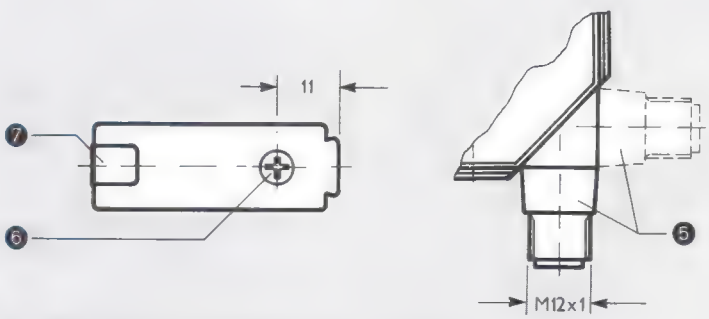
- Infinitely adjustable scanning range
- Background suppression
- Blinking signal strength indicator to show misalignment and provide forewarning of failure
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$
- Switching outputs short circuit protected
- Insensitive to ambient light
- No false triggering on power-up
- Metal housing, zinc diecasting or stainless steel



Background suppression
A = scanning range
B = background blanking range
C = background

WT 12



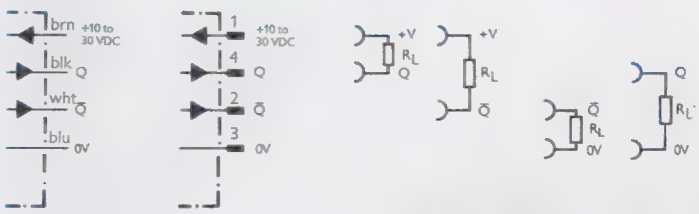


1. M4 threaded mounting hole, 4 mm deep
2. Centre of receiver optical axis
3. Centre of sender optical axis
4. Connecting cable, 2 m long
5. 4-pin plug
6. Scanning range control
7. Signal strength indicator

Mounting brackets and cable receptacles: see Accessories (page 147, 150)

Connection diagram

WT 12-N1 -N4 -N -P
-P 1 -P 4 NPN PNP



brn	blk	wht	blu
brown	black	white	blue

WT 12
photoelectric proximity switch with background suppression

WT 12	N	P
Scanning range,[1] adjustable	20 to 130 mm	
Scanning range	5 to 20 mm and 5 to 130 mm	
Supply voltage V_S	10 to 30 VDC (limit values)	
Current consumption (no load)	≦ 40 mA	
Ripple[2]	≦ 5 V_{pp}	
Light sender	LED, infrared modulated, average life 100 000 h[3]	
Light-spot diameter	4 mm at distance of 80 mm	
Transistor outputs	NPN	PNP
Signal voltage HIGH	approx. V_S	V_S – (≦ 1.8 V)[4]
Signal voltage LOW[4]	≦ 1.8 V[4]	approx. 0 V
Output current I_A max.	≦ 100 mA	
Response time[5]; Switching freq., max.[6]	500 µs; 1000/s	
Enclosure rating	IP 67 (dusttight, watertight)	
Protection circuits[7]	A, B, C	
Ambient operating temp.[8]	–40 to +55 °C	
Storage temperature[8]	–40 to +75 °C	
Weight	with plug 130 g; with connecting cable 200 g	

1) Object with 6/18 % reflection (based on white standard, to DIN 5033)
2) Must remain within V_S tolerances
3) At room temperature = +25 °C
4) At room temperature = +25 °C and 100 mA output current
5) With resistive load
6) With light/dark ratio of 1:1
7) A = Vs connections reverse-polarity protected
   B = Q and $\overline{Q}$ outputs short circuit protected
   C = Interference suppression
8) Do not deform connecting cables at temperatures below 0 °C; do not operate adjusting knob at temperatures below –25 °C

Selection table

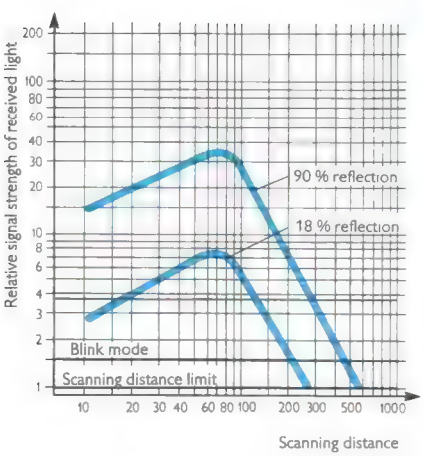
	Housing	Connection cable (2 m)		Plug (4-pin, below)		Plug (4-pin, rear)	
	Model	Part no.	Model	Part no.	Model	Part no.	
with background suppression	Standard housing	N 1121	1010808	N 4181	1010809		
		P 1121	1010597	**P 4181**	**1010810**	P 4171	1011056
	Stainless steel	N 1122	1011062	N 4182	1011064		
		P 1122	1011063	**P 4182**	**1011065**	P 4172	1011067

Adjustable scanning range

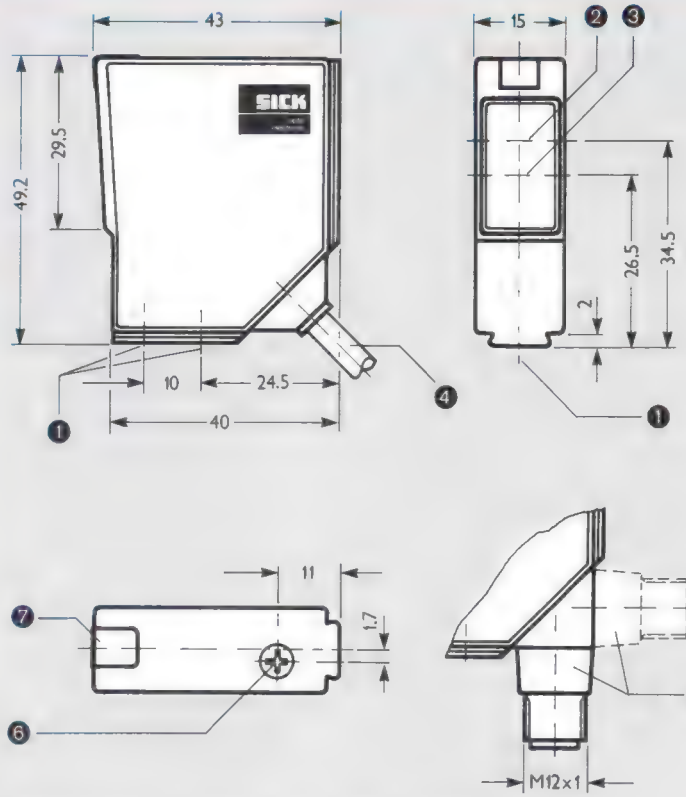
80 to 400 mm

Features

- Adjustable scanning distance
- Blinking signal strength indicator to show misalignment and provide forewarning of failure
- Supply connections reverse-polarity protected
- Complementary switching outputs Q and $\overline{Q}$
- Switching outputs short-circuit protected
- Insensitive to ambient light
- No false triggering on power-up
- Metal housing, zinc diecasting or stainless steel



WT 12



1. M4 threaded mounting hole, 4 mm deep
2. Centre of receiver optical axis
3. Centre of sender optical axis
4. Connecting cable, 2 m long
5. 4-pin plug
6. Sensitivity control
7. Signal strength indicator

Mounting brackets and cable receptacles: see Accessories (page 147, 150)

Connection diagram

brn	blk	wht	blu
brown	black	white	blue

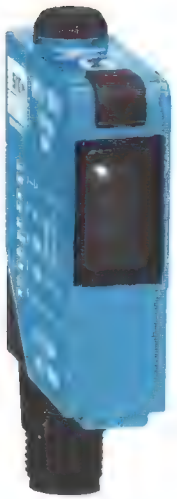
WT 12
photoelectric proximity switch
energetic

WT 12	N	P
Scanning range, adjustable[1]	80 to 400 mm	
Supply voltage V_S	10 to 30 VDC (limit values)	
Current consumption (no load)	≦ 40 mA	
Ripple[2]	≦ 5 V_{pp}	
Light sender	LED, infrared modulated, average life 100 000 h[3]	
Light-spot diameter	12 mm at distance of 400 mm	
Transistor outputs	NPN	PNP
Signal voltage HIGH	approx. V_S	V_S – (≦ 1.8 V)[4]
Signal voltage LOW[4]	≦ 1.8 V[4]	approx. 0 V
Output current I_A max.	≦ 100 mA	
Response time[5]; Switching freq., max.[6]	500 µs; 1000/s	
Enclosure rating	IP 67	
Protection circuits[7]	A, B, C	
Ambient operating temp.[8]	–40 to +55 °C	
Storage temperature[8]	–40 to +75 °C	
Weight	approx. 130 g	

1) Object with 90 % reflection (based on white standard, to DIN 5033)
2) Must remain within V_S tolerances
3) At room temperature = +25 °C
4) At room temperature = +25 °C and 100 mA output current
5) With resistive load
6) With light/dark ratio of 1:1
7) A = V_S connections reverse-polarity protected
   B = Q and $\overline{Q}$ outputs short circuit protected
   C = Interference suppression
8) Do not deform connecting cables at temperatures below 0 °C; do not operate adjusting knob at temperatures below –25 °C

Selection table

	Housing	Connection cable (2 m)		Plug (4-pin, below)		Plug (4-pin, behind)	
		Model	Part no.	Model	Part no.	Model	Part no.
energetic	Standard housing	N 1521	1010741	N 4581	1010745		
		P 1521	1010742	**P 4581**	**1010743**	P 4571	1011060
	Stainless steel	N 1522	1011074	N 4582	1011076		
		P 1522	1011075	**P 4582**	**1011077**	P 4572	1011079

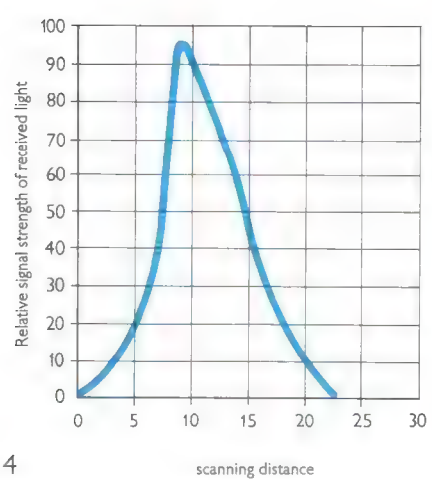


Scanning range

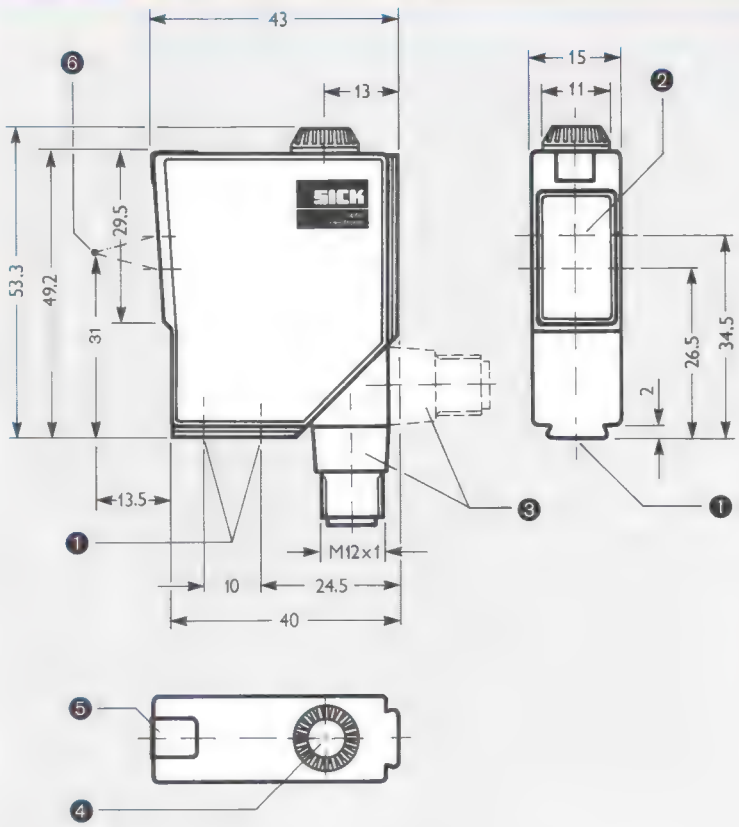
13.5 mm

Features

- LED light sender (green)
- Supply connections reverse-polarity protected
- Insensitive to ambient light
- Light- or dark-switching, selection via control line
- Status indicator
- Switching frequency up to 1.3 kHz
- Solid metal housing, zinc diecasting or stainless steel
- Adjustable sensitivity
- NPN and PNP switching outputs



WT 12-B 5781

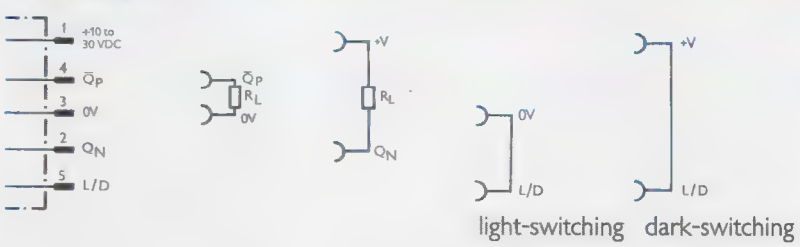


1. M4 threaded mounting hole, 4 mm deep
2. Centre of receiver optical axis
3. 5-pin plug
4. Sensitivity control
5. Signal strength indicator
6. Scanning plane

Mounting brackets and cable receptacles: see Accessories (page 147, 150)

Connection diagram

WT 12-B 5781



WT 12-B 5781
contrast sensor
with low switching hysteresis

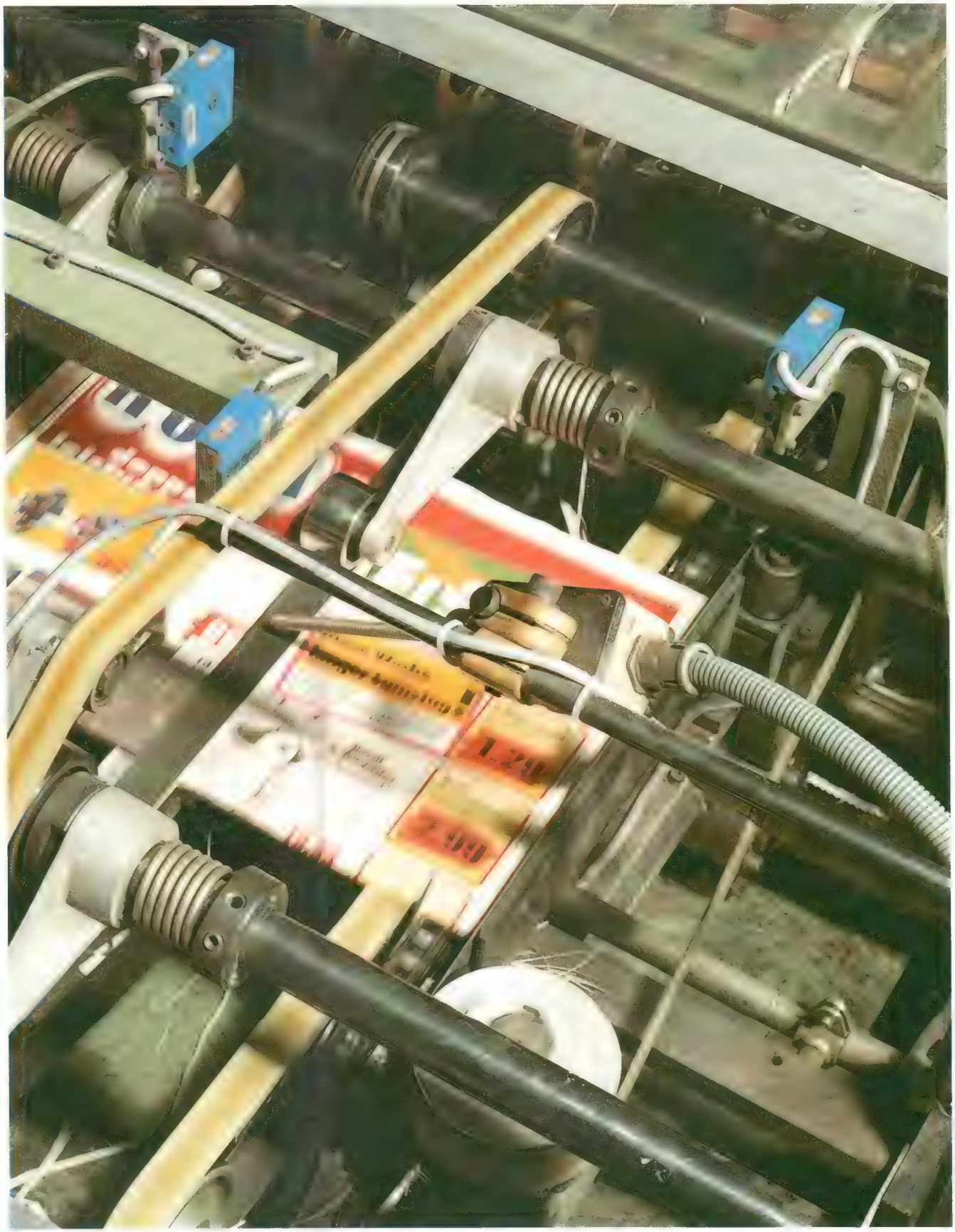
WT 12-B 5781		
Scanning distance	13.5 mm	
Scanning-distance tolerance	± 1.5 mm	
Light-spot diameter	2 mm	
Supply voltage V_S	10 to 30 VDC (limit values)	
Current consumpt. (no load) at 24 VDC	≦ 25 mA	
Ripple[1]	≦ 5 V_{pp}	
Light sender	LED, modulated, average life 100 000 h[2]	
Light wavelength	565 nm (green)	
Switching outputs Q_P and Q_N	light- or dark-switching, reversible L/D via control line	
Operating mode	PNP	NPN
Signal voltage HIGH	V_S – ≦ 2V	V_S
Signal voltage LOW	0 V	≦ 2 V
Output current I_A max.	100 mA	100 mA
L/D control input	0 V or unswitched: light-switching	
L/D control input	V_S: dark-switching	
Resp. time, max., Switching freq., max.[3]	360 µs; 1300/s	
Enclosure rating	IP 67	
Protection circuits[4]	A, B, C	
Ambient operating temp.	–25 to +55 °C	
Storage temperature	–25 to +75 °C	
Weight	approx. 130 g	

1) Must remain within Vs tolerances
2) At room temperature = +25 °C
3) With scanning ratio 1:1
4) A = V_S connections reverse-polarity protected
   B = Q_P and Q_N outputs short-circuit protected
   C = Interference suppression

Selection table

Housing	Plug, below		Plug, rear	
	Model	Part no.	Model	Part no.
Standard housing	B 5771	1011061	**B 5781**	**1010823**
Stainless steel	B 5772	1011081	**B 5782**	**1011080**

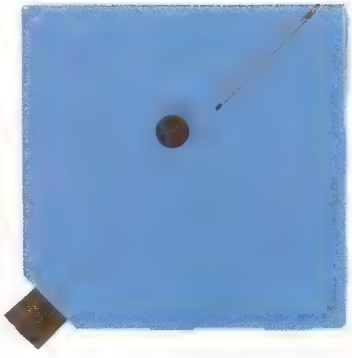
Accessories: 2 m connecting cable with straight cable connector: part no. 6008899
2 m connecting cable with right angle cable connector: part no. 6008900



SP 10 / EP 10

2000 mm

LP 10



650 mm

Miniature photoelectric switch in a die-cast housing. For high ambient temperatures up to +100 °C.
High switching accuracy by virtue of focussed (small) light spot. Spot clearly visible.
NPN or PNP transistor outputs.
High switching frequency (10,000 per second).
Non-detachable cable.
Supply voltage range 10 to 30 V; incandescent lamp voltage 3 or 1.5 VAC/DC. Enclosure rating IP 64 (dusttight, waterproof).
Available as through-beam photoelectric switch and photoelectric reflex switch.

Simple to mount using tapped holes at front and underneath.

Non-detachable cable and easily replaceable incandescent-lamp module.

Scanning distance

2000 mm

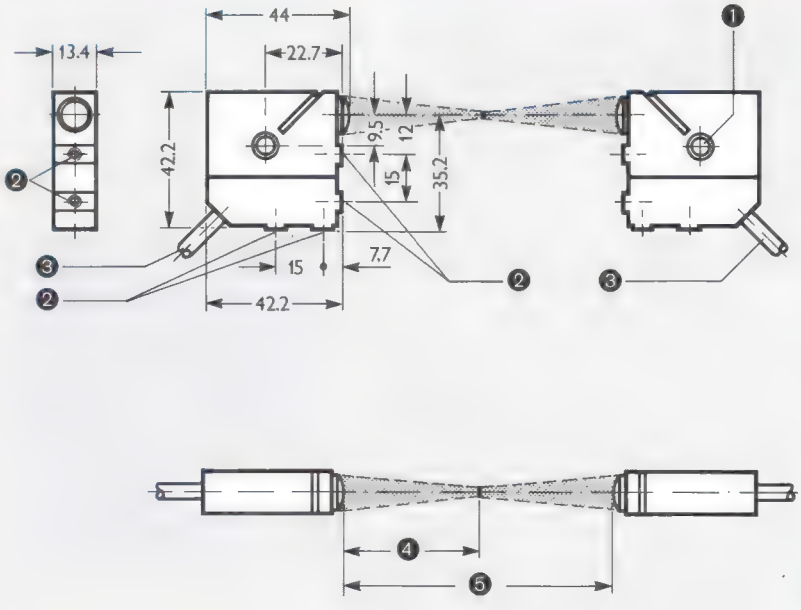
Features

- Supply connections reverse-polarity protected
- NPN or PNP transistor outputs
- Built-in switching amplifier
- Light- or dark-switching
- Die-cast metal housing
- For ambient temperatures up to +100 °C

SP 10 / EP 10

Dimensions in mm

SP 10 Sender **EP 10 Receiver**



1. Mounting hole through enclosure, I.D. 4.3 mm, recessed on both sides, Af 4 DIN 74
2. Threaded mounting holes M4, 3.5 mm deep
3. Connecting cable, 2 m long
4. Focal plane distance
5. Scanning distance

Connection Diagram

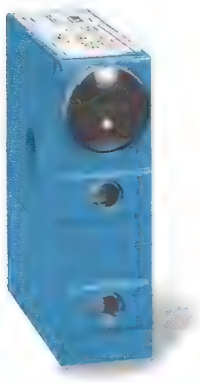
SP 10 **EP 10** **NPN** **PNP**

yel	grn	red	wht	blk
yellow	green	red	white	black
VAC/DC	0 V	+ V	Q	0 V

SP 10 / EP 10
Through-beam Photoelectric Switch

SP 10 / EP 10	SP 10 Sender		EP 10 Receiver					
Model	**-0211**	**-0411**	**-5401**	**-6401**	**-3201**	**-3401**	**-4201**	**-4401**
Part No.	1006330	1006332	1005375	1005379	1005365	1005367	1005369	1005371
Type of connection	cable							
Focal plane distance[1]								
With objective lens No. 2	33 mm	–						
With objective lens No. 4	–	650 mm	–					
Scanning distance								
With objective lens No. 2	–				115 mm	–	115 mm	–
With objective lens No. 4	–		2000 mm		–	2000 mm	–	2000 mm
Supply voltage V_S	3 VAC/DC		10 to 30 VDC[2]					
Power consumpt./current consumpt. (no load)[3]			≦18 mA		≦12 mA			
Ripple[4]			≦3 V_{pp}					
Light source[5]	incandescent lamp		–					
Type of light	visible light		–					
Average source life	80,000 h		–					
Light spot size at focal plane distance	2 x 1 mm²	22 x 11 mm²	–					
Light receiver switching mode[6]	–		L	D	L		D	
Switching output	–		PNP		NPN			
Signal voltage HIGH / switching voltage max.	–		V_S – (≦1.0 V)		V_S – (≦0.7 V)			
Signal voltage LOW[7]	–		≦0.7 V		≦1.0 V			
Output current max.	–		200 mA					
Response time[8]; switching frequency[9]	–		≦50 µs; ≦10,000/s					
Enclosure rating	IP 67							
Circuit protection	–		reverse-polarity protected					
Ambient operating temperature[10] [11]	–20 to +100 °C							
Storage temperature[10]	–25 to +100 °C							
Connecting cable	2 m, 2 x 0.25 mm², flex		2 m, 3 x 0.25 mm², flex, PVC, screened signal core					
Weight	130 g							

1) Always select light sender and light receiver with same objective lens No.
2) Limit values
3) 0.7 VA at 3 V; 0.45 VA at 1.5 V
4) Must be within V_S tolerances
5) Either 3 V lamp (Part No. 1002802) or 1.5 V lamp (Part No. 1000444) may be used
6) L = light-switching, D = dark-switching
7) At room temperature = +25 °C and output current of 200 mA
8) With resistive load
9) With light/dark time ratio of 1:1
10) Do not distort cable below 0 °C
11) Continuous temperature in excess of +80 °C can affect the service life of electronic components



Scanning Distance

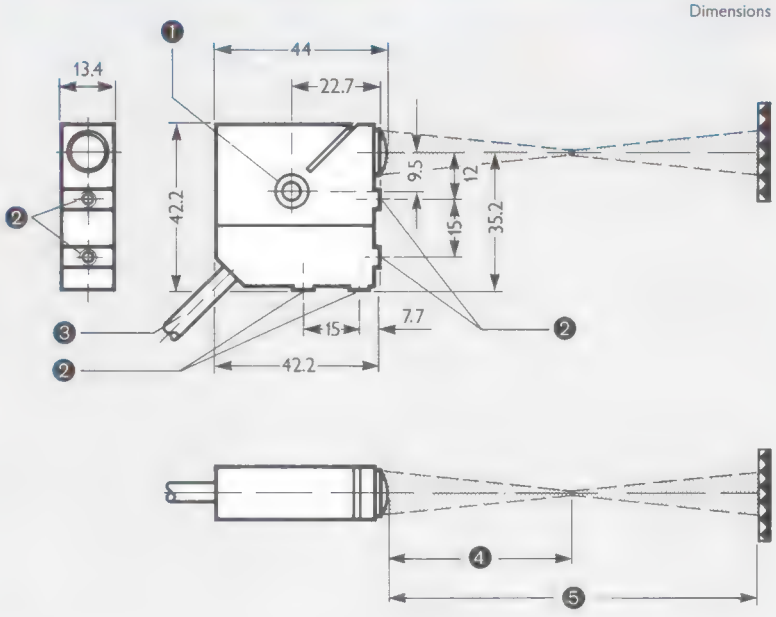
650 mm

Features

- Supply connections reverse-polarity protected
- NPN or PNP transistor outputs
- Built-in switching amplifier
- Light- or dark-switching
- Die-cast metal housing
- For ambient temperatures up to + 100 °C

LP 10

Dimensions in mm

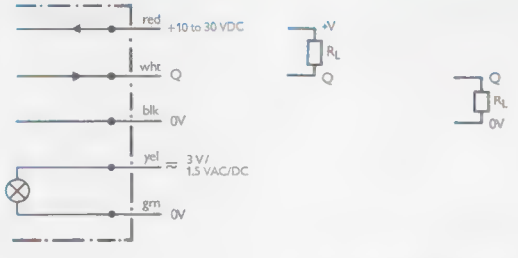


1. Mounting hole through enclosure, I.D. 4.3 mm, recessed on both sides, Af 4 DIN 74
2. Threaded mounting holes M4, 3.5 mm deep
3. Connecting cable, 2 m long
4. Focal plane distance
5. Scanning distance

Fork reflector (accessories), Part No. 1001143
Sender lamp 1.5 V/0.5 W (accessories), Part No. 1000444
Sender lamp 3 V/0.7 W (accessories), Part No. 1002802
Mounting rail with clamp (accessories), Part No. 1000664

Connection Diagram

LP 10 **NPN** **PNP**



red	wht	blk	yel	grn
red	white	black	yellow	green
+ V	Q	0 V	3 V	0 V

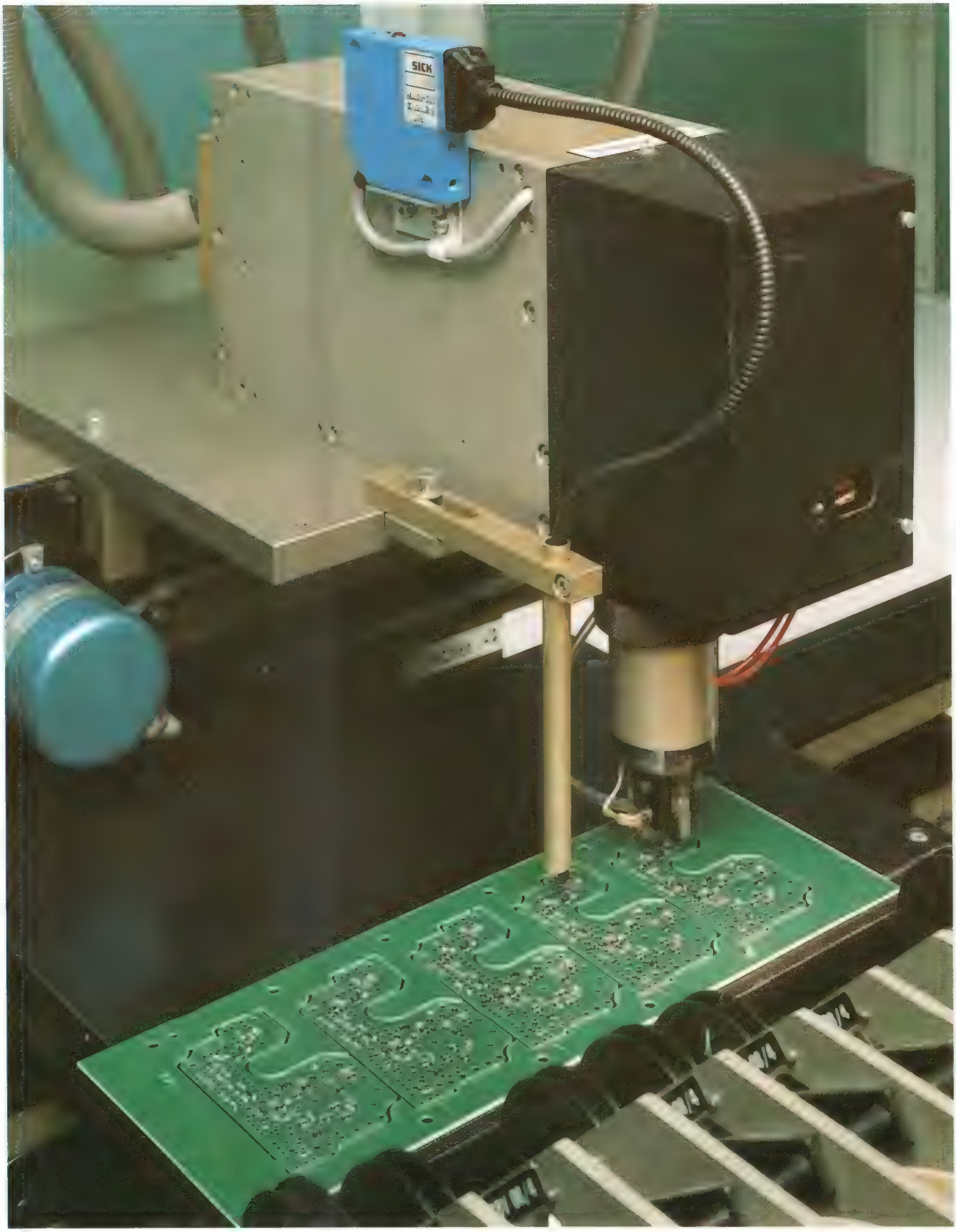
LP 10
Photoelectric Reflex Switch

LP 10 Model	-3.	-4.	-5.	-6.
Part No.	see Selection Table			
Type of connection	cable			
Focal plane distance				
With objective lens No. 2	approx. 33 mm			
With objective lens No. 3	approx. 90 mm			
With objective lens No. 4	approx. 650 mm			
Scanning distance	see Selection Table			
Supply voltage V_S	10 to 30 VDC[1] for amplifier, 3 V or 1.5 VAC/DC for sender lamp			
Current consumption of amplifier[2]	≦18 mA		≦12 mA	≦18 mA
Light source[3]	incandescent lamp, visible light, white, average service life 80,000 h			
Power consumption of sender lamp	0.7 VA at 3 V; 0.45 VA at 1.5 V			
Light spot dimensions[4]				
With objective lens No. 2	approx. 2 x 1 mm^2			
With objective lens No. 3	approx. 4 x 2 mm^2			
With objective lens No. 4	approx. 22 x 11 mm^2			
Light receiver switching mode	light-switching	dark-switching	light-switching	dark-switching
Switching output	NPN		PNP	
Signal voltage HIGH	V_S – 0.7 V		V_S – 1.0 V	
Signal voltage LOW[5]	≦1.0 V		≦0.7 V	
Output current max.	200 mA			
Response time[6]; switching frequency[7]	≦50 µs; ≦10,000/s			
Enclosure rating	IP 64			
Circuit protection	reverse-polarity protected			
Ambient operating temperature[8] [9]	–20 to +100°C			
Storage temperature[8]	–25 to +100°C			
Connecting cable	2 m, 5 x 0.25 mm^2 flex, PVC, O.D. 5 mm, screened signal core			
Weight	130 g			

1) Limit values, ripple ≦ 3 V_{pp}
2) (No load)
3) Either 3 V lamp (Part No 1002802) or 1.5 V (Part No. 1000444) may be used
4) At focal plane distance
5) At room temperature = +25°C and output current of 100 mA
6) With resistive load
7) With light/dark time ratio of 1:1
8) Do not distort cable below 0°C
9) Continuous temperature in excess of +80°C can affect the service life of electronic components
10) L = light-switching; D = dark-switching

Selection Table

Model	Part No.	Objective lens No.	Switching outputs	L / D[10]	Scanning distance max., with reflector		
					SC 12 / SC 40	PL 26	PL 50
LP 10-3211	1006225	2	NPN	L	55 mm	–	–
LP 10-5211	1006233	2	PNP	L	55 mm	–	–
LP 10-6211	1006237	2	PNP	D	55 mm	–	–
LP 10-3311	1006226	3	NPN	L	95 mm	330 mm	440 mm
LP 10-4311	1006230	3	NPN	D	95 mm	330 mm	440 mm
LP 10-5311	1006234	3	PNP	L	95 mm	330 mm	440 mm
LP 10-6311	1006238	3	PNP	D	95 mm	330 mm	440 mm
LP 10-3411	1006227	4	NPN	L	–	650 mm	650 mm
LP 10-4411	1006231	4	NPN	D	–	650 mm	650 mm
LP 10-5411	1006235	4	PNP	L	–	650 mm	650 mm
LP 10-6411	1006239	4	PNP	D	–	650 mm	650 mm



 WLL 10 photoelectric fiber-optic switch detecting incorrect markings

Photoelectric Reflex Switches with Plug-In Fiber-Optic Cables

WLL 10

200 mm

40 mm

Photoelectric switches in die-cast metal housing with mounting bracket. With sensitivity control and status indicator.

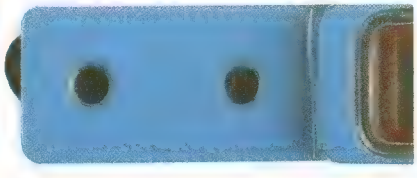
Non-detachable cable, enclosure rating IP 67 (dusttight, watertight). Supply voltage from 10 to 30 VDC.

Light- or dark-switching. Transistor outputs in NPN or PNP configuration, short circuit protected.

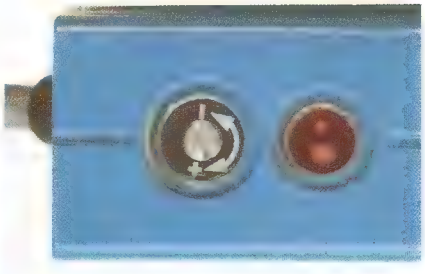
Photoelectric switch with infrared light; photoelectric proximity switch with infrared and visible red light.

WLL 10 photoelectric switch with interchangeable fiber-optic cables. Fiber-optic cables available for temperatures up to +250 °C.

Available as through-beam photoelectric switch, photoelectric reflex switch, photoelectric proximity switch and as photoelectric switch with plug-in fiber-optic cables.



In addition to mounting bracket, threaded mounting holes M4.



Top part with sensitivity control, power indicator and alignment sight.

Scanning Distance

30 to 200 mm

For through-beam applications

Scanning Distance

0.5 to 40 mm

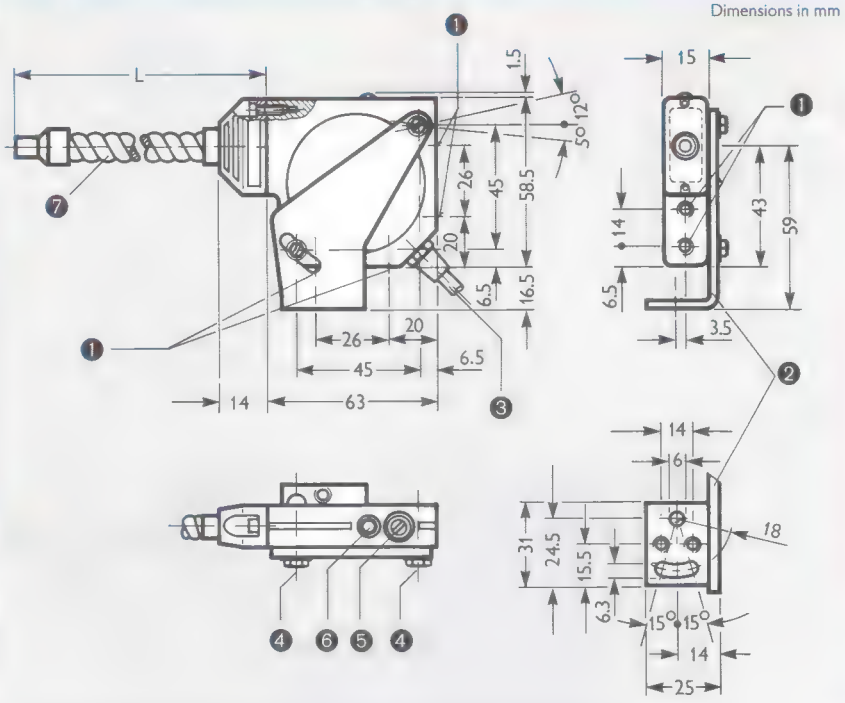
For proximity applications

Features

- Fiber-optic cables in 1 or 2 tip configurations of various lengths
- Fiber-optic cables with metal jacket, with or without PVC covering
- Built-in switching amplifier
- Light- or dark-switching (depending upon model used)
- Switching outputs short circuit protected, PNP or NPN
- Insensitive to ambient light
- Adjustable sensitivity
- Die-cast housing

WLL 10

Dimensions in mm

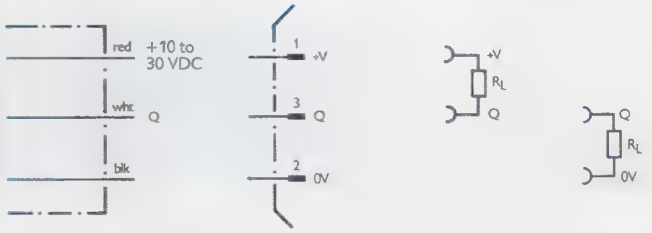


L = Length of fiber-optic cable; see Selection Table, page 126

1. Threaded mounting holes M4, 4.5 mm deep
2. Mounting bracket (included)
3. Connecting cable, 3 m long
4. 4-mm mounting holes through enclosure, recessed on both sides for M4 hex nut
5. Sensitivity control
6. Signal strength indicator
7. Fiber-optic cable (to be ordered separately); see page 126

Connection Diagram

WLL 10 **WLLC 10** **NPN** **PNP**



red	wht	blk
red	white	black

WLL 10
Photoelectric Fiber-optic Switch

WLL 10	-3103	-3203	-7303	-7403	-9103	-9203	-9303	-9403
With plug-in fiber-optic cables								
Part No.	1004541	1004542	1004539	1004540	1004543	1004544	1004537	1004538
Type of connection	cable							
Scanning range for white standard[1])	0.5 to 20 mm		0.5 to 5 mm		0.5 to 20 mm		0.5 to 5 mm	
for 7610 reflective tape	1 to 40 mm		1 to 10 mm		1 to 40 mm		1 to 10 mm	
Scanning distance for through-beam applic.	200 mm		30 mm		200 mm		30 mm	
Supply voltage V_S[2])	10 to 30 VDC (limit values)							
Current consumption (no load)	≤ 28 mA							
Ripple[3])	≤5 V_{PP}							
Light source	LED, average service life 100,000 h[4])							
Type of light	infrared		red		infrared		red	
Angle of dispersion	65°							
Light receiver switching mode[5])	L	D	L	D	L	D	L	D
Signal strength indicator	LED (red)							
Switching output	NPN				PNP			
Signal voltage HIGH	V_S				V_S (−1.5 V)			
Signal voltage LOW[6])	≤1.5 V				0V			
Output current max.	150 mA							
Response time[7]); switching frequeny max.[8])	<500 µs; 1000/s		<200 µs; 2500/s		<500 µs; 1000/s		<200 µs; 2500/s	
Enclosure rating[9])	IP 67							
Circuit protection	V_S input reverse-polarity protected; transistor output short-circuit protected							
Voltage V_S/housing, max.	60 V							
Ambient operating temperature[10])	0 to +55°C		−25 to +55°C					
Storage temperature[10])	−25 to +70°C							
Connecting cable	3 m, 3 x 0.25 mm² flex, PVC, O.D. 5 mm, screened signal core							
Weight[11])	360 g							

1) The scanning range is reduced for diffusely reflecting materials with a low reflectance
2) Switching devices for mains connection available on request
3) Must be within V_S tolerances
4) At room temperature = +25°C
5) L = light-switching, D = dark-switching
6) At room temperature = +25°C and output current of 100 mA
7) With resistive load
8) With light/dark time ratio of 1:1
9) Only with fiber-optic cable or protective cover
10) Do not distort cable below 0°C
11) Including connecting cable and mounting bracket, but excluding fiber-optic cable

WLL 10 with 4-pin cable plug and 110 mm intermediate cable length

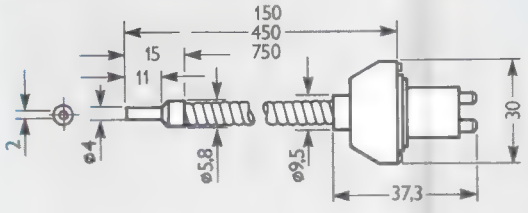
Model	Part No.	Corresponding opto-electronically to:
WLLC 10-910	1005397	WLL 10-9103
WLLC 10-920	1005398	WLL 10-9203
WLLC 10-930	1005395	WLL 10-9303
WLLC 10-940	1005396	WLL 10-9403

Accessories	Part No.
Connecting cable (specify length in meters)	6004538
Connecting cable, 2 m, with receptacle	2006748
Connecting cable, 5 m, with receptacle	2006749
Cable plug	6001447
Cable receptacle	6001448

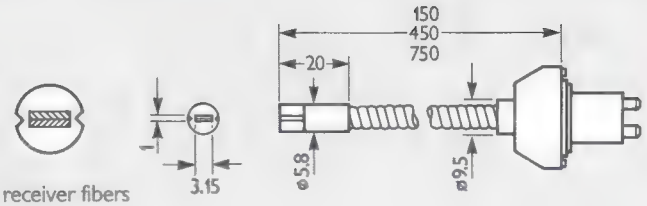
Fiber-optic Cables for WLL 10

Dimensions in mm

LM 1

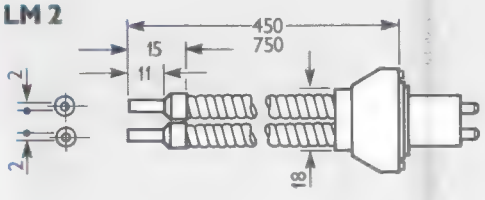


LM 5

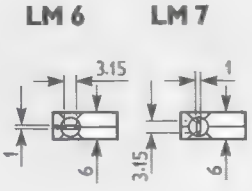


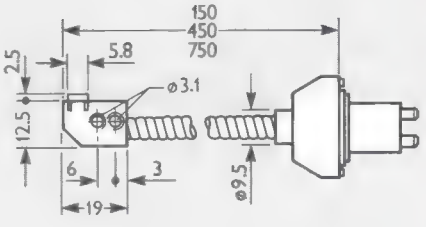
Sender and receiver fibers optically isolated (LM 5, LM 6, LM 7)

LM 2

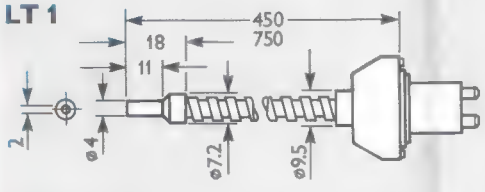


LM 6 **LM 7**

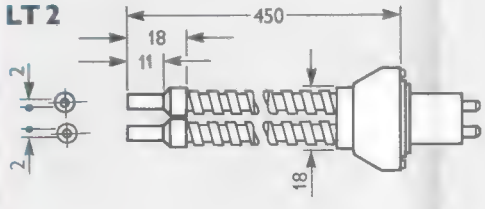




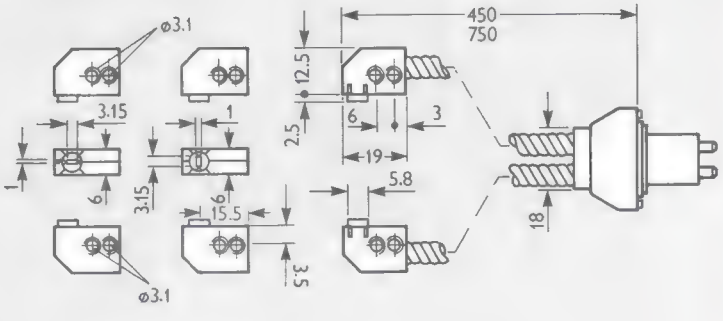
LT 1



LT 2



LM 8 **LM 9**



Fiber-optic Cable Selection Table (Part No. must be quoted when ordering equipment)

Fiber-optic cable	LM 1	LM 2	LM 5	LM 6	LM 7	LM 8	LM 9	LT 1	LT 2
1-tip configuration	×		×	×	×			×	
2-tip configuration		×				×	×		×
L = 150 mm, Part No.	1 004 504	–	1 004 743	1 005 072	1 005 069	–	–	–	–
L = 450 mm, Part No.	1 004 505	1 004 506	1 004 744	1 005 073	1 005 070	1 005 077	1 005 075	1 004 509	1 004 510
L = 750 mm, Part No.	1 004 507	1 004 508	1 004 745	1 005 074	1 005 071	1 005 078	1 005 076	1 004 511	1 004 512
Opt. effective diameter	2 mm		[1]			1 × 3.15 mm		2 mm	
Ambient operating temperature	–10 to +60°C[2][3]							–25 to +250°C[4]	
Armouring	Helical metal spring covered with PVC							[5]	
Min. bending radius	20 mm								
L = 150 mm, weight approx.	18 g	–	18 g	18 g	18 g	–	–	–	–
L = 450 mm, weight approx.	36 g	63 g	36 g	36 g	36 g	63 g	63 g	40 g	71 g
L = 750 mm, weight approx.	55 g	102 g	55 g	55 g	55 g	102 g	102 g	60 g	112 g

1) 0.5 x 3.15 mm, sender and receiver fibers separate
2) Not to be loaded mechanically outside ambient temperature range
3) Do not distort cable below 0°C
4) Watch equipment temperature: metal jacket can transmit heat. Cooling should be provided where appropriate.
5) Chromium-plated helical metal spring

W 260 Series
Photoelectric Switches

WS 260 / WE 260

WL 260

WT 260

Photoelectric switches in glassfiber-reinforced plastic housing. Through-beam photoelectric with great scanning distance; photoelectric reflex switch with polarizing filter; photoelectric proximity switch with great scanning distance.

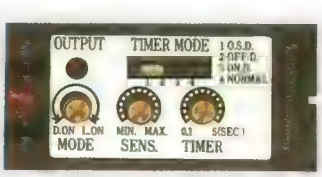
With LED status indicator to facilitate set-up and alignment.

With terminal chamber and two-position cable entry gland.

Supply voltage ranges from 10 to 30 VDC or 12 to 240 VDC/24 to 240 VAC, allowing the sensor to be used for a great variety of switching and controlling applications.

Overcurrent, short circuit and reverse-polarity protected; no false triggering on power-up.

Insensitive to ambient light through interference pulse suppression. Electrical and optical imminent-failure signalling. (DC)
Light- or dark-switching, switch-selectable.
Time delays adjustable from 0.1 to 5 s; OFF-delay, ON-delay, ONE SHOT or no delay (NORMAL) selectable on AC model.



Time delay control, mode selector and sensitivity control

Slotted masks to detect small objects or to increase the operating precision.

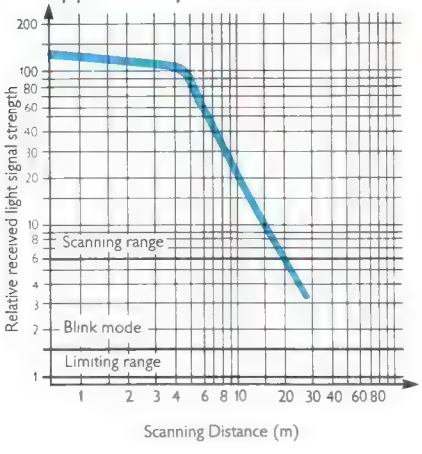
Two-position entry gland and terminal chamber

Scanning Distance

20 m

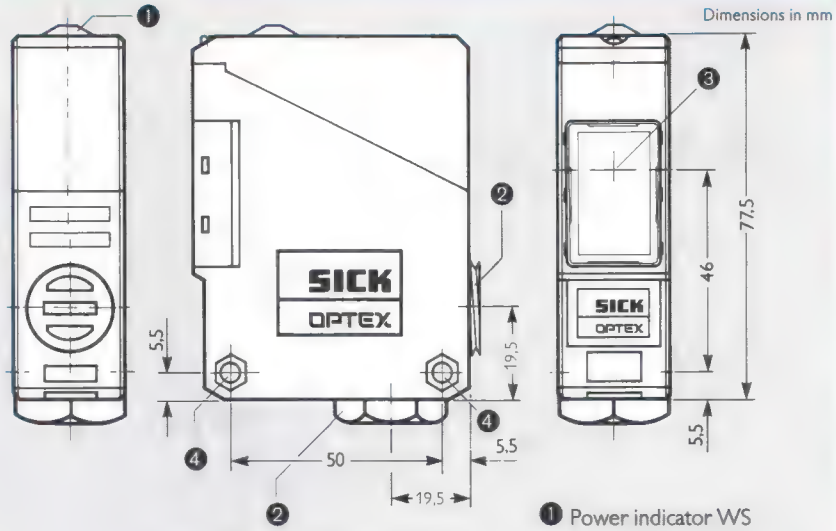
Features:

- Adjustable sensitivity
- Blinking LED status indicator to show misalignment (DC)
- Switch-selectable time delays (AC)
- Output to signal dirt build-up on optics (DC)
- Light- or dark-switching, switch-selectable
- AC or AC/DC supply voltage ranges
- Two-position cable entry gland (90° apart)
- Glassfiber-reinforced plastic housing
- Transistor outputs, overload and short circuit protected
- Test input to test sensor on demand from remote location (DC)
- Approved by UL and CSA

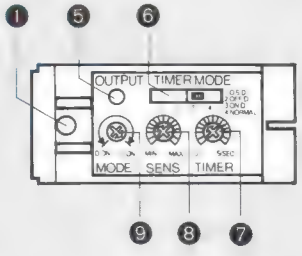


WS 260 / WE 260

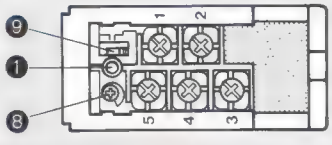
Dimensions in mm



–S/–R 230



–N/–P 230



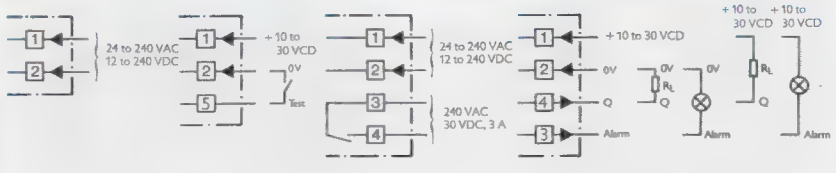
1. Power indicator WS
   Status indicator WE
2. Cable entry gland, $^1/_2$" PF thread, for cable diameters from 6 to 10 mm
3. Centre of optical axis
4. Mounting holes through enclosure, recessed on both sides for M5 hex nut
5. LED output indicator (WE 260-R)
6. Time-delay selector switch (WE 260-R)
   1 ONE SHOT
   2 OFF-delay
   3 ON-delay
   4 No time delay (NORMAL)
7. Time-delay control 0.1 to 5 s (WE 260-R)
8. Sensitivity control
9. Mode selector (light-/dark-switching)

For mounting bracket (included), see page 147.
Plug available on request.

Connection Diagram

WS 260 **WE 260**

–U 230 **–D 230** **–S/–R 230** **–N/–P 230 P** **N**

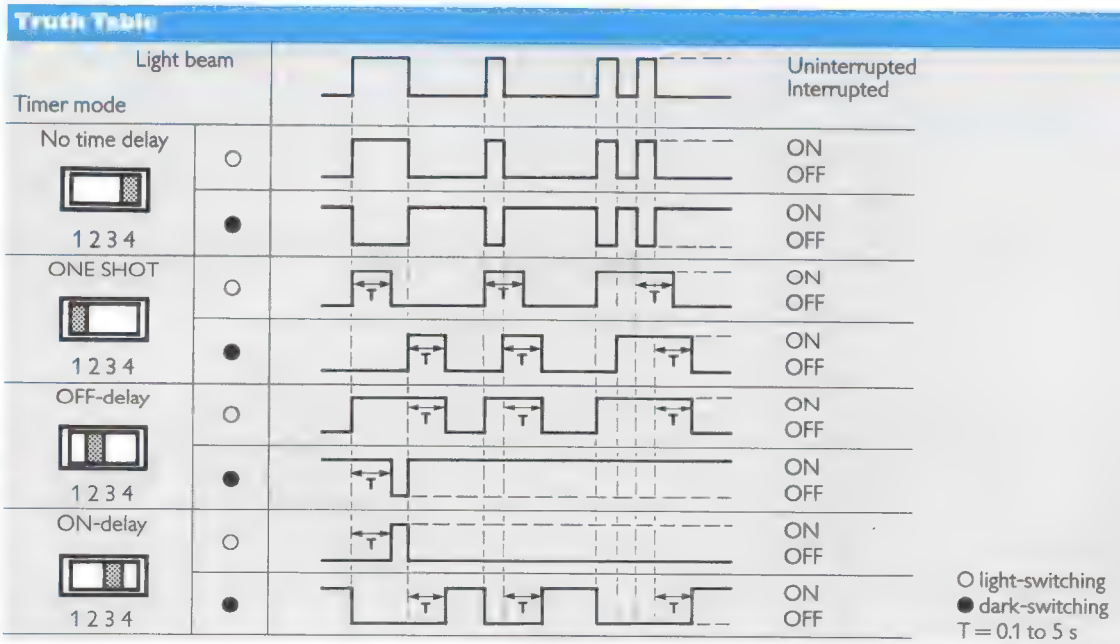


WS 260 / WE 260
Through-beam Photoelectric Switch

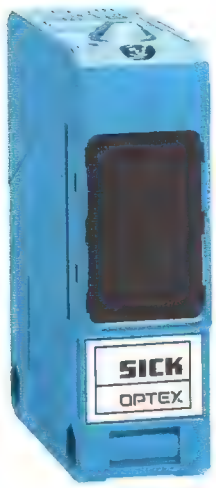
WS / WE 260	WS 260 Sender		WE 260 Receiver			
Model	**-U 230**	**-D 210**	**-S 230**	**-R 230**	**-P 230**	**-N 230**
Part No.	–		6008873[1]	6008872[1]	6008950[1]	6008951[1]
Type of connection	terminal chamber					
Scanning distance SD	20 m					
Light spot diameter[2]	350 mm					
Supply voltage V_S	12 to 240 VDC[3]) 24 to 240 VAC[3])	10 to 30 VDC	12 to 240 VDC[3]), 24 to 240 VAC[3])		10 to 30 VDC	
Current/power consumption (no-load)	≦1 VA	≦35 mA	≦2 VA		≦35 mA	
Ripple max.[4]		5 V_{PP}			5 V_{PP}	
Light source	LED, infrared, modulated, average service life 100.000 h[5])					
Light receiver switching mode	–		light-/dark-switching, switch-selectable			
Switching output	–		relay, 1 x NO, electrically isolated		PNP open collect.	NPN open collect.
Signal voltage HIGH	–		–		V_S (≦1 V)	approx. V_S
Signal voltage LOW	–		–		approx. 0 V	≦1 V
Output current max.	–		3 A/240 VAC 3 A/ 30 VDC		100 mA (200 mA)[6]	
Alarm output (static)	–		–		100 mA (200 mA)[6]	
Test input T_I	–	light source disconnected	–			
Response time; switching frequency max.	–		20 ms; 25/s		1 ms; 500/s	
Time delay with LED output indicator	–		–	switch-selectable	–	
Switch position	–		–	OFF-delay, ON-delay, ONE SHOT, no delay (NORMAL)	–	
Delay adjustable from	–		–	0.1 to 5 s	–	
Enclosure rating	IP 66					
Circuit protection[7]	A		A, C		A, B, C	
Ambient operating temperature	–25 to +55 °C					
Storage temperature	–40 to +70 °C					
Weight	approx. 120 g					

1) Package contains sender and receiver
2) At scanning distance SD
3) ± 10 %
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) Maximum current from switching output and alarm output: 200 mA
7) A = supply connections reverse-polarity protected
B = output Q overcurrent and short circuit protected
C = Interference suppression

Truth Table



O light-switching
● dark-switching
T = 0.1 to 5 s

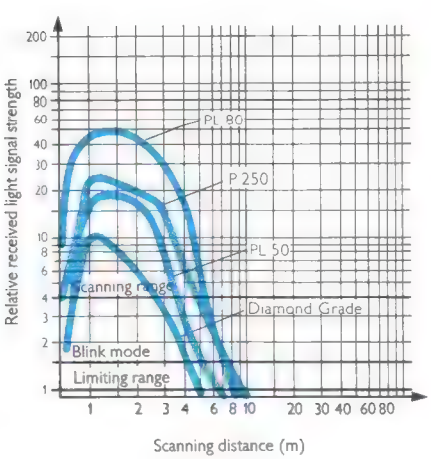


Scanning Distance

0.01 to 5 m

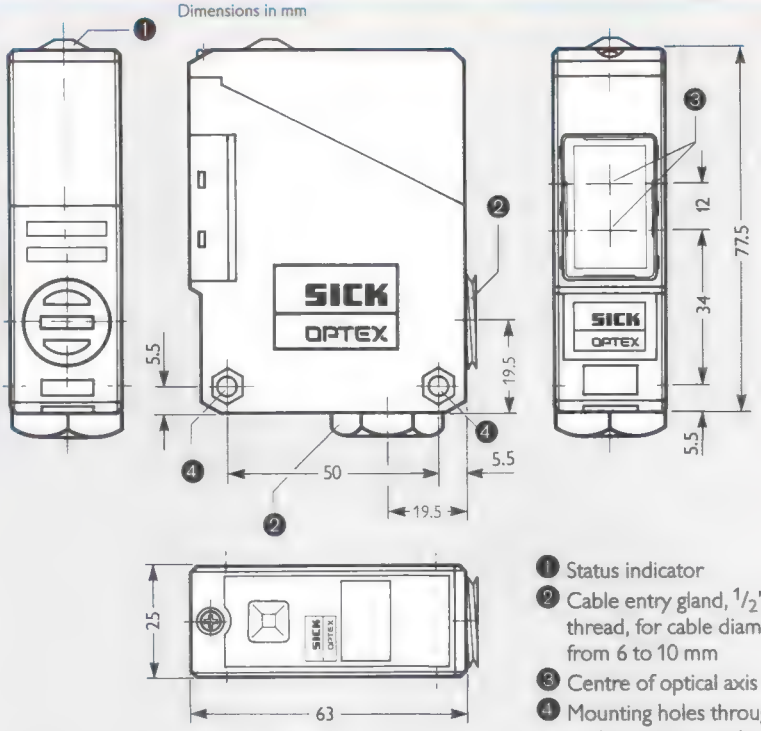
Features

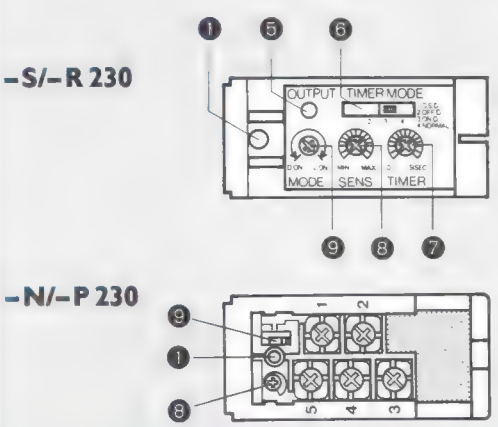
- Polarizing filter, enabling objects even with reflecting surfaces to be detected
- Light- or dark-switching, switch-selectable
- Adjustable sensitivity (DC)
- Blinking LED status indicator to show misalignment
- Switch-selectable time delays (AC)
- Output to signal dirt build-up on optics (DC)
- AC or AC/DC supply voltage ranges
- Two-position cable entry gland (90° apart)
- Glassfiber-reinforced plastic housing
- Transistor outputs, overload and short circuit protected
- Test input to test sensor on demand from remote location (DC)
- Approved by UL and CSA



WL 260

Dimensions in mm



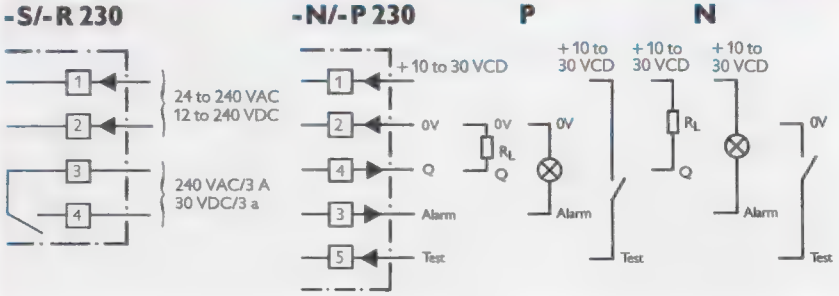


1. Status indicator
2. Cable entry gland, $^1/_2$" PF thread, for cable diameters from 6 to 10 mm
3. Centre of optical axis
4. Mounting holes through enclosure, recessed on both sides for M5 hex nut
5. LED output indicator (WL 260-R)
6. Time-delay selector switch (WL 260-R)
   1 ONE SHOT
   2 OFF-delay
   3 ON-delay
   4 No time delay (NORMAL)
7. Time-delay control 0.1 to 5 s (WL 260-R)
8. Sensitivity control
9. Mode selector (light-/dark-switching)

For reflector P 250 (included), see page 144.
Plug available on request.
For mounting bracket (include), see page 147.

Connection Diagram

WL 260

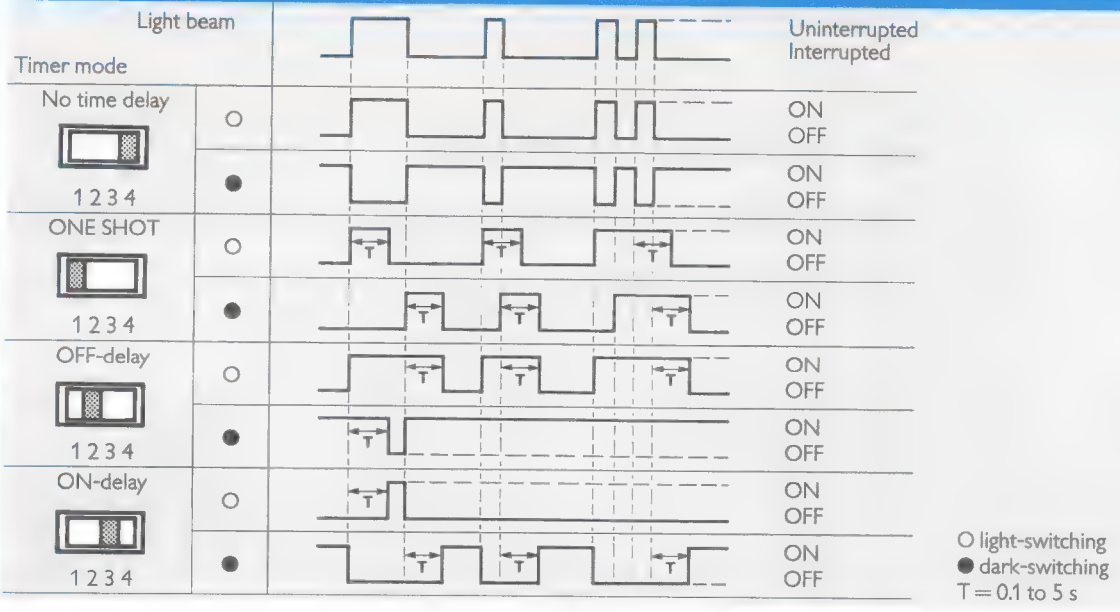


WL 260
Photoelectric Reflex Switch

WL 260	-S 230	-R 230	-P 230	-N 230
Part No.	6008773	6008772	6008952	6008953
Type of connection	terminal chamber			
Scanning range SR with reflector P 250	0.01 to 5 m			
Light spot diameter[1]	150 mm			
Supply voltage V_S	12 to 240 VDC[2], 24 to 240 VAC[2]		10 to 30 VDC	
Current/power consumption (no-load)	≤ 2 VA		≤ 35 mA	
Ripple max.[3]	–		5 V_{PP}	
Light source	LED, visible red light, modulated, average service life 100.000 h[4]			
Light receiver switching mode	light-/dark-switching, switch-selectable			
Switching output	relay, 1 x NO, electrically isolated		PNP open collect.	NPN open collect.
Signal voltage HIGH	–		V_S (≦ 1 V)	approx. V_S
Signal voltage LOW	–		approx. 0 V	≦ 1 V
Output current max.	3 A/240 VAC; 3 A/30 VDC		100 mA (200 mA)[5]	
Alarm output (static)	–		100 mA (200 mA)[5]	
Test input T_I	–		light source disconnected	
Response time; switching frequency max.	20 ms; 25/s		1 ms; 500/s	
Time delay with LED output indicator	–	switch-selectable	–	
Switch position	–	OFF-delay, ON-delay, ONE SHOT, no delay (NORMAL)	–	
Delay adjustable from	–	0.1 to 5 s	–	
Enclosure rating	IP 66			
Circuit protection[6]	A, C		A, B, C	
Ambient operating temperature	–25 to +55 °C			
Storage temperature	–40 to +70 °C			
Weight	approx. 120 g			

1) With scanning range SR
2) ± 10 %
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) Maximum current from switching output and alarm output: 200 mA
6) A = supply connections reverse-polarity protected
B = output Q overcurrent and short circuit protected
C = interference suppression

Truth Table



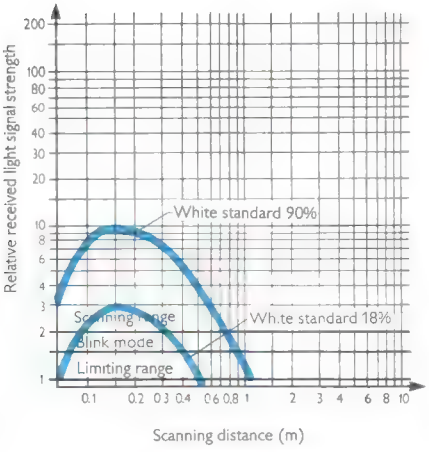
O light-switching
● dark-switching
T = 0.1 to 5 s

Adjustable Scanning Distance

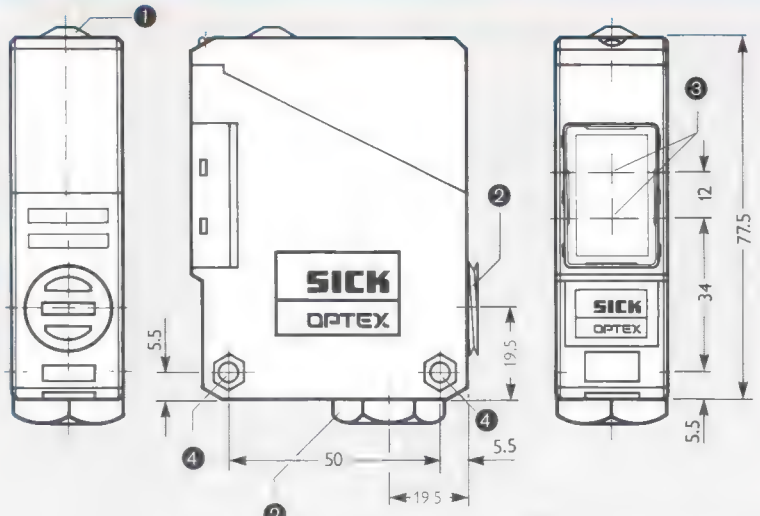
800 mm

Features:

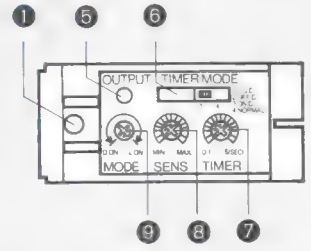
- Adjustable scanning distance
- Light- or dark-switching, switch-selectable
- Blinking LED status indicator to show misalignment (DC)
- Switch-selectable time delays (AC)
- Output to signal dirt build-up on optics (DC)
- DC or AC/DC supply voltage ranges
- Glassfiber-reinforced plastic housing
- Two-position cable entry gland (90° apart)
- Transistor outputs, overload and short circuit protected
- Test input to test sensor on demand from remote location
- Approved by UL and CSA



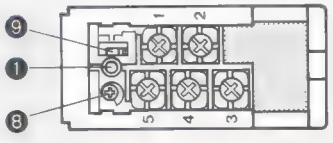
WT 260



–S/–R 230



–N/–P 230



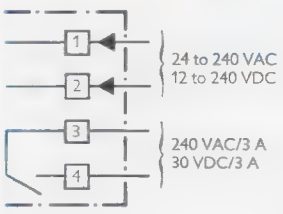
1 LED status indicator
2 Cable entry gland, $^1/_2$" PF thread, for cable diameters from 6 to 10 mm
3 Centre of optical axis
4 Mounting holes through enclosure, recessed on both sides for M5 hex nut
5 LED output indicator (WT 260-R)
6 Time-delay selector switch (WT 260-R)
1 ONE SHOT
2 OFF-delay
3 ON-delay
4 No time delay (NORMAL)
7 Time-delay control 0.1 to 5 s (WT 260-R)
8 Sensitivity control
9 Mode selector (light-/dark-switching)

For mounting bracket (included), see page 147.
Plug available on request.

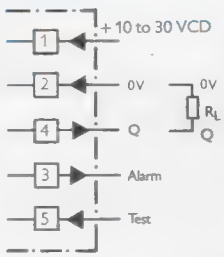
Connection Diagram

WT 260

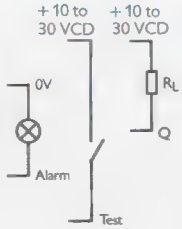
–S/–R 230



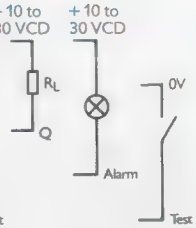
–N/–P 230



P



N

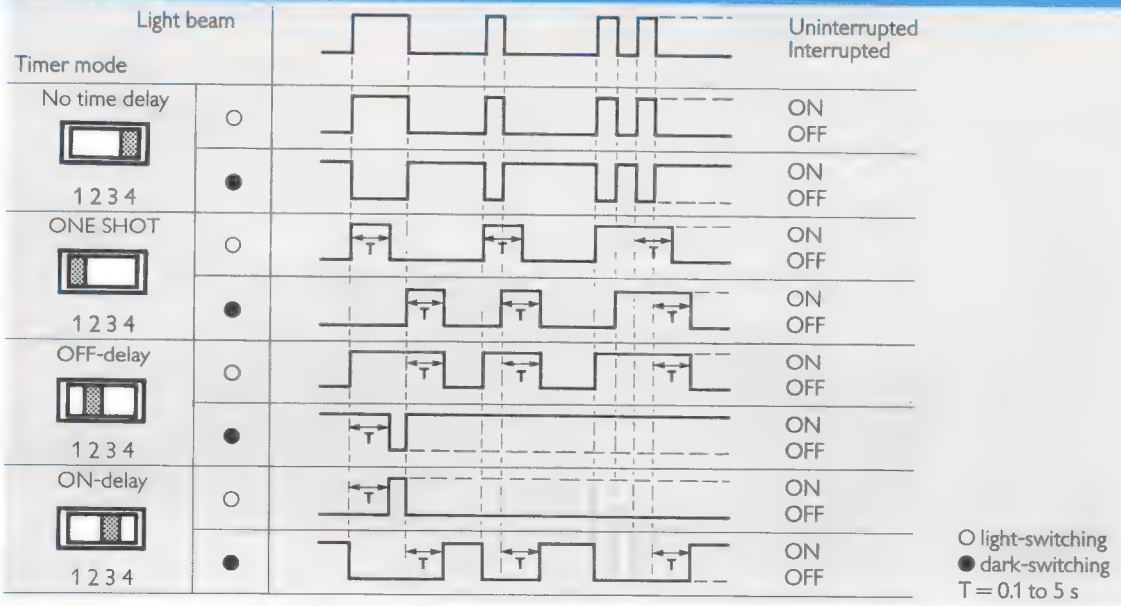


WT 260
Photoelectric Proximity Switch

WT 260	-S 230	-R 230	-P 230	-N 230
Part No.	6008775	6008774	6008954	6008955
Type of connection	terminal chamber			
Scanning distance SD, adjustable[1]	800 mm			
Light spot diameter[2]	15 mm			
Supply voltage V_S	12 to 240 VDC[3], 24 to 240 VAC[3]		10 to 30 VDC	
Current/power consumption (no-load)	≤ 2 VA		≤ 35 mA	
Ripple max.[4]	–		5 V_{PP}	
Light source	LED, infrared, average service life 100.000 h[5]			
Light receiver switching mode	light-/dark-switching, switch-selectable			
Switching output	relay, 1 x NO, electrically isolated		PNP open collect.	NPN open collect.
Signal voltage HIGH	–		V_S (≤ 1 V)	approx. V_S
Signal voltage LOW	–		approx. 0 V	≤ 1 V
Output current max.	3 A/240 VAC; 3 A/30 VDC		100 mA (200 mA)[6]	
Alarm output (static)	–		100 mA (200 mA)[6]	
Test input T_I	–		light source disconnected	
Response time; switching frequency max.	20 ms; 25/s		1 ms; 500/s	
Time delay with LED output indicator	–	switch-selectable	–	
Switch position	–	OFF-delay, ON-delay, ONE SHOT, no delay (NORMAL)	–	
Delay adjustable from	–	0.1 to 5 s	–	
Enclosure rating	IP 66			
Circuit protection[7]	A, C		A, B, C	
Ambient operating temperature	–25 to +55 °C			
Storage temperature	–40 to +70 °C			
Weight	approx. 120 g			

1) Based on white standard 90%
2) At scanning distance SD
3) ± 10 %
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) Maximum current from switching output and alarm output: 200 mA
7) A = supply connections reverse-polarity protected
B = output Q overcurrent and short-circuit protected
C = interference suppression

Truth Table



○ light-switching
● dark-switching
T = 0.1 to 5 s

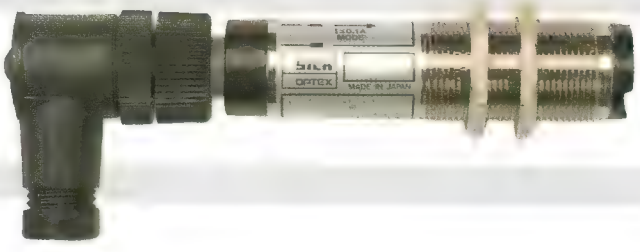
 VT 180 photoelectric proximity switch detecting the packing and controlling glue spreading in the next operation

V 180 Series
Photoelectric Switches

VS 180 / VE 180

15 m

VL 180



3 m
1 m*)

*) with polarizing filter

VT 180

110 mm
400 mm

Photoelectric switches of cylindrical design in threaded metal housing, M 18 x 1.

Small-size, compact design.

Signal strength indicator for easy commissioning and adjustment.

Over-current and reverse-polarity protected; no false triggering on power-up.

Due to interference suppression insensitive to ambient light.

Photoelectric reflex switch with infrared light (scanning distance: 3 m) or visible red light and polarizing filter (scanning distance: 1 m).

Photoelectric proximity switch with optimized scanning distance: 110 mm or 400 mm.

Status indicator and sensitivity control

Available as through-beam photoelectric switch, as photoelectric reflex switch and as photoelectric proximity switch.

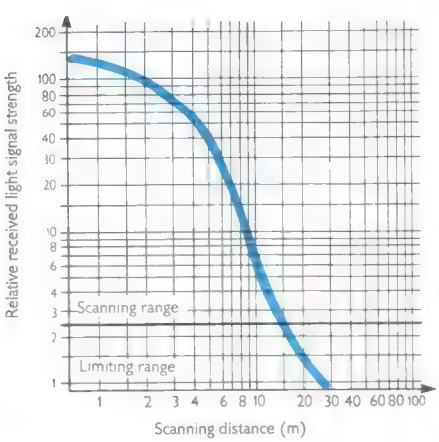
Plug for individual cable length and flexibility

Scanning Distance

15 m

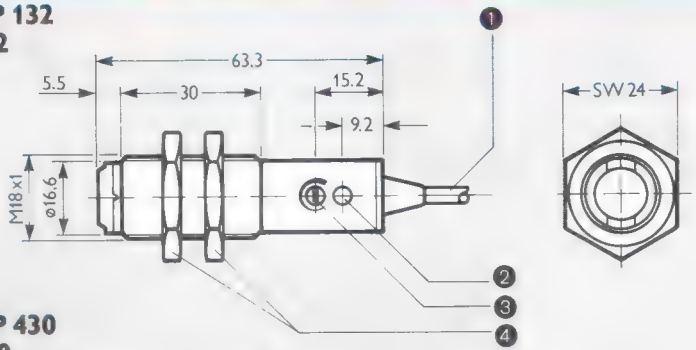
Features:

- Supply connections reverse-polarity protected
- LED indicator for receiving status, on VS: power indicator
- Built-in switching amplifier
- Light- and dark-switching (L/D control wire), (DC)
- Adjustable sensitivity (VE), (DC)
- No false triggering on power-up
- Metal housing
- Output with over-current protection
- Test input to test the device and the complete system (DC)
- With connecting cable or plug
- Simple fitting
- Right-angle adapter (accessories)

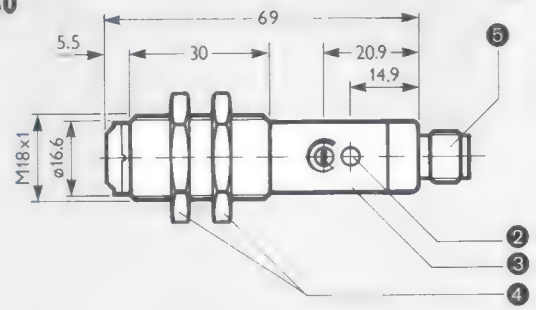


VS 180/VE 180

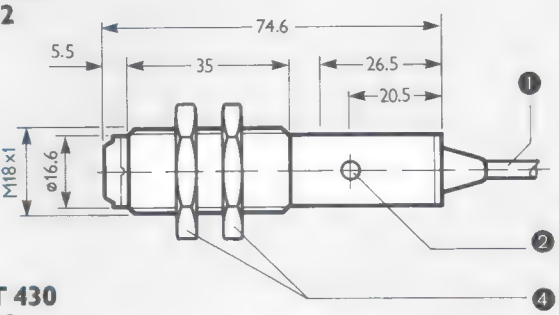
–N/–P 132
–D 132



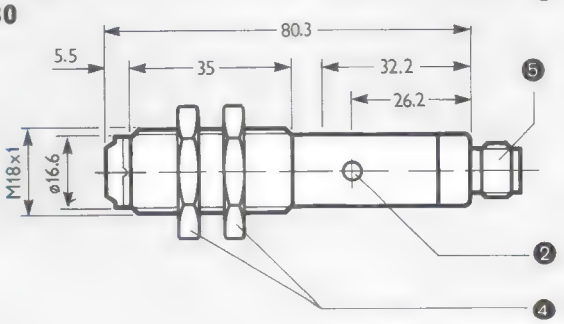
–N/–P 430
–D 430



–S/–T 132
–U 132



–S/–T 430
–U 430



❶ Connecting cable
❷ Signal strength indicator on VE 180 (power indicator on VS 180)
❸ Sensitivity control (279°-potentiometer) on VE 180 (DC only)
❹ Mounting nuts
❺ Plug (for cable receptacles, see: Accessories, page 150)

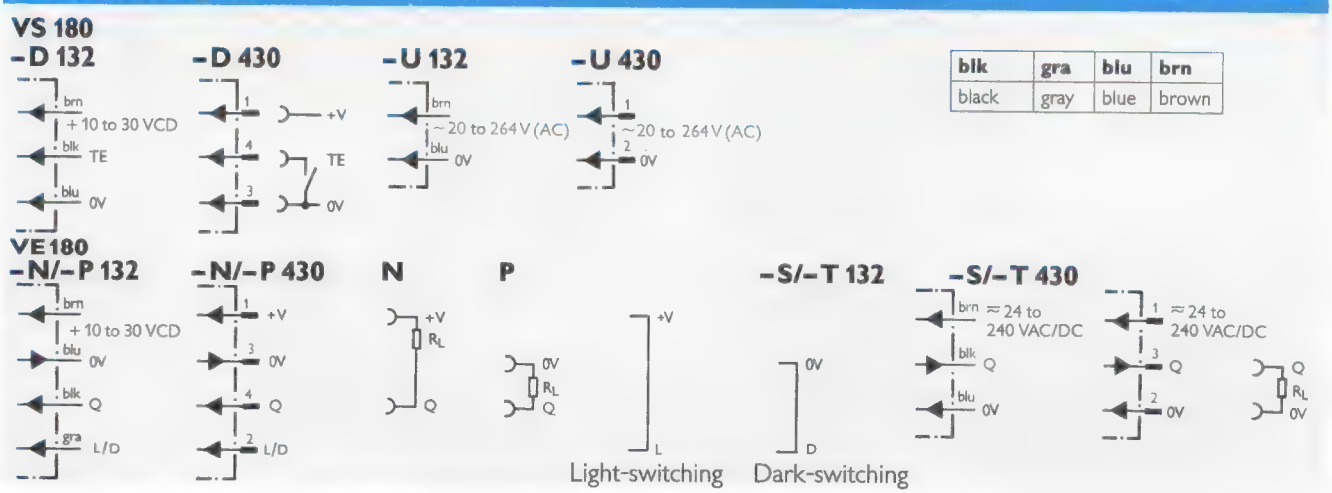
For right-angle adapter (accessories), Part no. 1009707, see page 152.

VS 180 / VE 180 Through-beam Photoelectric Switch

Through-beam Photoelectric Switch	VS 180 Sender		VE 180 Receiver			
Model with connecting cable	-D 132	-U 132	-N 132	-P 132	-S 132	-T 132
Part No.	–		6008865[1)]	6008864[1)]	6008943[1)]	6008944[1)]
Model with plug	-D 430	-U 430	-N 430	-P 430	-S 430	-T 430
Part No.	–		6008867[1)]	6008866[1)]	6008945[1)]	6008946[1)]
Scanning distance[2)]	15 m					
Light spot diameter[3)]	800 mm					
Supply voltage V_s[4)]	10 to 30 VDC	20 to 264 VAC	10 to 30 VDC		20 to 264 VAC	
Power consumption	≦ 25 mA	≦ 5 mA	≦ 25 mA (without load)		≦ 5 mA	
Ripple max.[5)]	5 V_{pp}	–	5 V_{pp}		–	
Light source	LED, infrared, modulated, average service life: 100,000 h[6)]					
Light receiver switching mode	–		light- and dark-switching, (L/D control wire[7)]		dark-switching	light-switching
Sensitivity	–		adjustable		–	
Status indicator	LED					
Switching outputs			NPN[8)]	PNP[8)]	FET	
Signal voltage HIGH			approx. V_s	V_s – (≦ 1 V)	–	
Signal voltage LOW			≦ 1 V	approx. 0 V	–	
Output current max.			100 mA		250 mA[9)]	
Response time; switching frequency, max.			1.5 ms; 333/s		15 ms; 33/s	
Test input	light source disconnected	–	–			
Enclosure rating	IP 66					
Circuit protection[10)]	A	–	A, B, C		B, C	
Ambient operating temperature	–25 to +55 °C					
Storage temperature	–40 to +70 °C					
Connecting cable	2 m, 3 x 0.34 mm² PVC Ø 5 mm	2 m, 2 x 0.34 mm² PVC Ø 5 mm	2 m, 4 x 0.34 mm² PVC Ø 5 mm		2 m, 3 x 0.34 mm² PVC Ø 5 mm	
Weight with connecting cable	125 g					
Weight with plug	65 g					

1) The Part No. includes sender and receiver unit
2) The scanning range is reduced by about 20% with right-angle adapter
3) At scanning distance
4) Limit values
5) Must be within V_s tolerances
6) At room temperature = +25 °C
7) Control wire open
NPN: light-switching
PNP: dark-switching
8) Open collector
9) A/10 ms f=5 Hz
10) A = V_s connections reverse-polarity protected
B = output over-current protected
C = interference suppression

Connection Diagram



blk	gra	blu	brn
black	gray	blue	brown

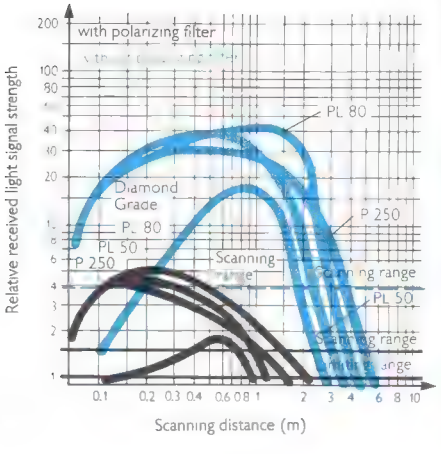
Scanning Distance

3 m
1 m*)

*) with polarizing filter

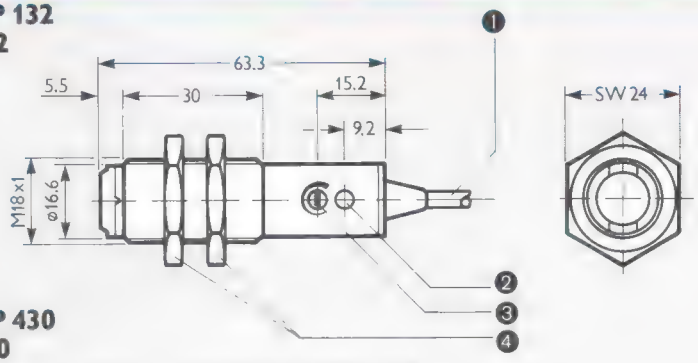
Features

- Polarizing filter, enabling objects even with reflecting surfaces tobe detected
- Supply connections reverse-polarity protected
- LED status indicator
- Built-in switching amplifier
- Light- and dark-switching (L/D control wire)
- Adjustable sensitivity
- No false triggering on power-up
- Metal housing
- Output with over-current protection
- With connecting cable or plug
- Simple fitting
- Right-angle adapter (accessories)

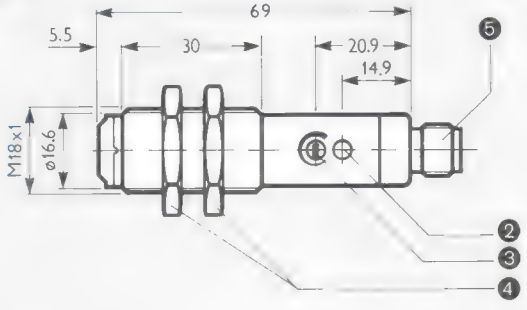


VL 180

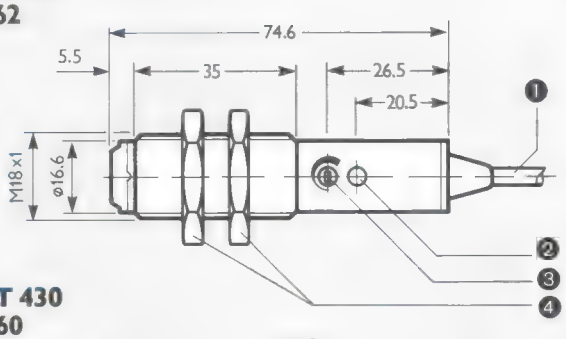
–N/–P 132
–D 162



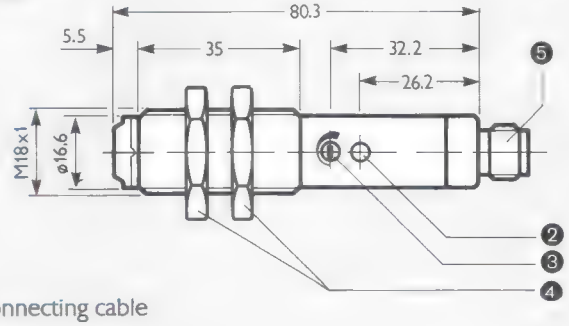
–N/–P 430
–D 460



–S/–T 132
–U 162



–S/–T 430
–U 460



1. Connecting cable
2. Status indicator
3. Sensitivity control (270°-potentiometer, not with polarizing-filter version)
4. Mounting nuts
5. Plug (for cable receptacle, see: Accessories, page 150)

For P 250 reflector (included), see page 144
For right-angle adapter (accessories), Part No. 1005 389, see page 152.

VL 180
Photoelectric Reflex Switch

VL 180	without polarizing filter				with polarizing filter			
Model with connecting cable	-P 132	-N 132	-S 132	-T 132	-P 162	-N 162	-S 162	-T 162
Part No.	6008779	6008780	6008921	6008922	6008783	6008784	6008925	6008926
Model with plug	-P 430	-N 430	-S 430	-T 430	-P 460	-N 460	-S 460	-T 460
Part No.	6008781	6008782	6008923	6008924	6008785	6008786	6008927	6008928
Scanning distance[1] with P 250 polarizing filter	0.05 to 3 m				0.05 to 1 m			
Light spot diameter[2]	150 mm				50 mm			
Supply voltage V_S[3]	10 to 30 VDC		20 to 264 VAC		10 to 30 VDC		20 to 264 VAC	
Power consumption (without load)	≦ 30 mA		≦ 5 mA		≦ 30 mA		≦ 5 mA	
Ripple, max.[4]	5 V_{pp}		–		5 V_{pp}		–	
Light source	LED, infrared, modulated[5]				LED, red, modulated[5]			
Light receiver switching mode	light- and dark-switching, (L/D control wire)		dark-switching	light-switching	light- and dark-switching (L/D control wire)		dark-switching	light-switching
Switching outputs	PNP[7]	NPN[7]	FET		PNP[7]	NPN[7]	FET	
Signal voltage HIGH	V_S – (≦ 1 V)	approx. V_S	–		V_S – (≦ 1 V)	approx. V_S	–	
Signal voltage LOW	approx. 0 V	V_S ≦ 1 V	–		approx. 0 V	≦ 1 V	–	
Output current, max.	100 mA		250 mA[8]		100 mA		250 mA[8]	
Response time; switching frequency, max.	1.5 ms; 333/s		15 ms; 33/s		1.5 ms; 333/s		15 ms; 33/s	
Enclosure rating	IP 66							
Circuit protection[9]	A, B, C		B, C		A, B, C		B, C	
Ambient operating temperature	–25 to +55 °C							
Storage temperature	–40 to +70 °C							
Connecting cable	2 m, 4 x 0.34 mm², PVC ø 5 mm		2 m, 3 x 0.34 mm² PVC ø 5 mm		2 m, 4 x 0.34 mm² PVC ø 5 mm		2 m, 3 x 0.34 mm², PVC ø 5 mm	
Weight with connecting cable	125 g							
Weight with plug	65 g							

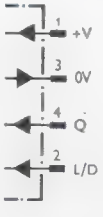
1) The scanning distance is reduced by about 20% with right-angle adapter
2) At scanning distance
3) Limit values
4) Must be within V_S tolerances
5) Average service life at room temperature = 25 °C: 100,000 h
6) Control wire open
NPN: light-switching
PNP: dark-switching
7) Open collector
8) 1 A/10 ms f = 5 Hz
9) A = V_S connections reverse-polarity protected
B = output over-current protected
C = interference suppression

Connection Diagram

VL 180

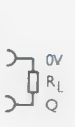
–N/–P 132
–N/–P 162

–N/–P 430
–N/–P 460

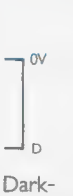


N

P

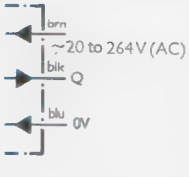


Light-switching

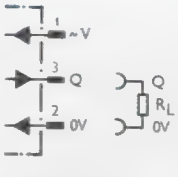


Dark-switching

–S/–T 132
–S/–T 162

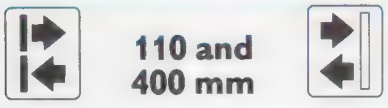


–S/–T 430
–S/–T 460



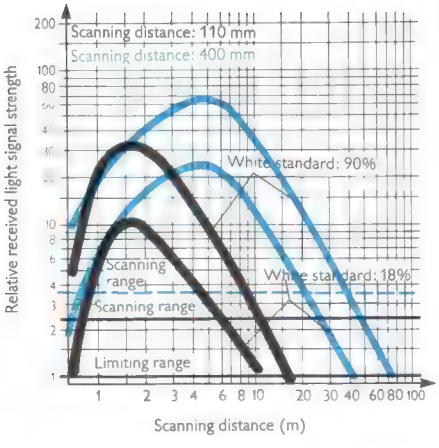
blk	gra	blu	brn
black	gray	blue	brown

Scanning Distance



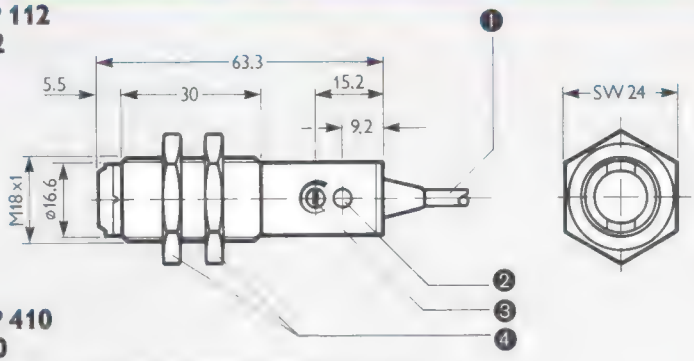
Features

- Supply connection reverse-polarity protected
- LED status indicator
- Built-in switching amplifier
- Light- and dark-switching (L/D control wire)
- Adjustable sensitivity
- No false triggering on power-up
- Metal housing
- Output with over-current protection
- With connecting cable or plug
- Simple fitting
- Right-angle adapter (accessories)

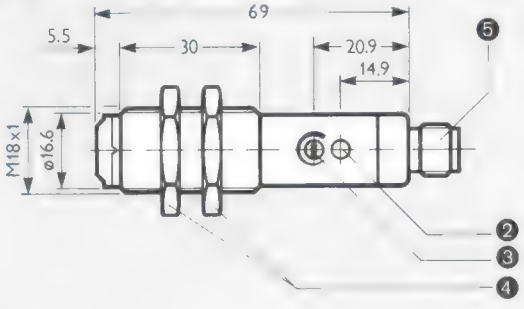


VT 100

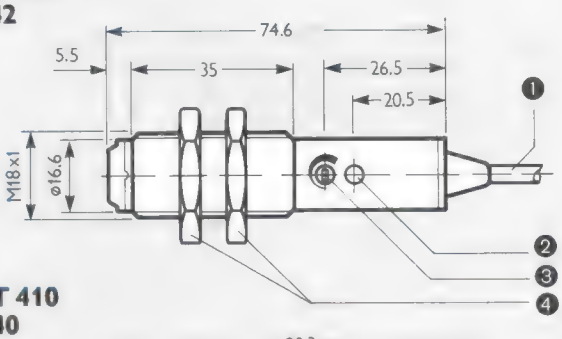
–N/–P 112
–D 142



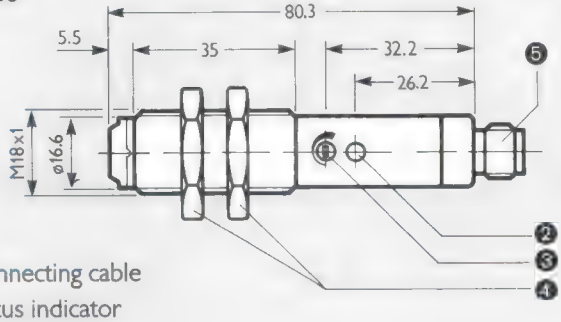
–N/–P 410
–D 440



–S/–T 112
–U 142



–S/–T 410
–U 440



1. Connecting cable
2. Status indicator
3. Sensitivity control
4. Mounting nuts
5. Plug (for cable receptacle, see: Accessories, page 150)

For right-angle adapter (accessories), Part No. 1005 390, see page 152.

VT 180
Photoelectric Proximity Switch

VT 180	Scanning distance: 110 mm				Scanning distance: 400 mm			
Model with connecting cable	-P 112	-N 112	-S 112	-T 112	-P 142	-N 142	-S 142	-T 142
Part No.	6008787	6008788	6008929	6008930	6008791	6008792	6008933	6008934
Model with plug	-P 410	-N 410	-S 410	-T 410	-P 440	-N 440	-S 440	-T 440
Part No.	6008789	6008790	6008931	6008932	6008793	6008794	6008935	6008936
Scanning distance, adjustable[1]	110 mm[2]				400 mm[2]			
Light spot diameter[3]	65 mm				30 mm			
Supply voltage V_S[4]	10 to 30 VDC		20 to 264 VAC		10 to 30 VDC		20 to 264 VAC	
Power consumption (without load)	≦ 30 mA		≦ 5 mA		≦ 30 mA		≦ 5 mA	
Ripple, max.[5]	5 V_{pp}		–		5 V_{pp}		–	
Light source	LED, infrared, modulated, average service life: 100,000 h[6]							
Light receiver switching mode	light- and dark-switching, (L/D control wire[7])		dark-switching	light-switching	light- and dark-switching, (L/D control wire[7])		dark-switching	light-switching
Switching outputs	PNP[8]	NPN[8]	FET		PNP[8]	NPN[8]	FET	
Signal voltage HIGH	V_S- (≦1 V)	approx. V_S	–		V_S- (≦1 V)	approx. V_S	–	
Signal voltage LOW	approx. 0 V	V_S ≦1 V	–		approx. 0 V	V_S ≦1 V	–	
Output current, max.	100 mA		250 mA[9]		100 mA		250 mA[9]	
Response time; switching frequency, max.	1.5 ms; 333/s		15 ms; 33/s		1.5 ms; 333/s		15 ms; 33/s	
Enclosure rating	IP 66							
Circuit protection[10]	A, B, C		B, C		A, B, C		B, C	
Ambient operating temperature	–25 to +55 °C							
Storage temperature	–40 to +70 °C							
Connecting cable	2 m, 4 x 0.34 mm², PVC ø 5 mm		2 m, 3 x 0.34 mm² PVC ø 5 mm		2 m, 4 x 0.34 mm² PVC ø 5 mm		2 m, 3 x 0.34 mm², PVC ø 5 mm	
Weight with connecting cable	125 g							
Weight with plug	65 g							

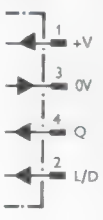
1) The scanning distance is reduced by about 20% with right-angle adapter
2) Based on white standard 90%
3) At scanning distance
4) Limit values
5) Must be within V_S tolerances
6) At room temperature = 25 °C
7) Control wire open
NPN = light-switching
PNP = dark-switching
8) Open collector
9) 1 A/10 ms f=5 Hz
10) A = V_S supply connections reverse-polarity protected
B = output over-current protected
C = interference suppression

Connection Diagram

VT 180

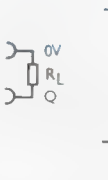
–N/–P 112
–N/–P 142

–N/–P 410
–N/–P 440



N

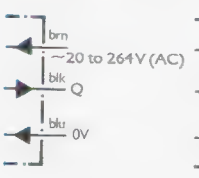
P



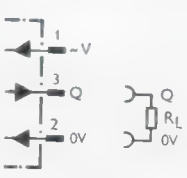
Light-switching

Dark-switching

–S/–T 112
–S/–T 142



–S/–T 410
–S/–T 440



blk	gra	blu	brn
black	gray	blue	brown


SICK

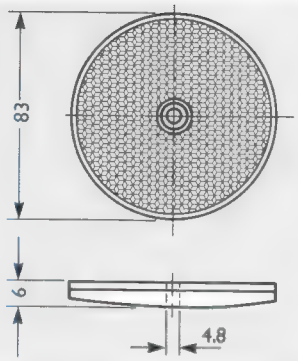
Accessories

Selection Table Reflectors

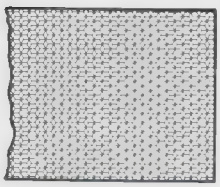
Description	Part No.	WL 6	WL 9	WL 18	WL 27	WL 36	WL 45	WL 12	WL 260	LP 10	VL 18	WL 25 Ex i	PFK 1
C 110	5304549	○	○	○	●	●	●	○	○	○	○		
OP 60-∞	1000141						●					○	
OP 61-∞, ambient temperature max. 300°C	1002627						●					○	
SW 50, ambient temperature max. 300°C	1000131	○	○	○	○	●	●	○	○	○	○	●	
PL 22-1 screw mounted	1003546	○	○	○	○	○	○	○	○	○	○		●
PL 22-2 self-adhesive	1003621	○	○	○	○	○	○	○	○	○	○		●
PL 22-3 screw mounted	1004488	○	○	○	○	○	○	○	○	○	○		●
PL 26	1001440	○	○	○	○	○	○	●	○	●	○		
PL 30	1002314	○	●	●	●	●	●	●	●		○		
PL 31[1])	1002315	○	○	○	○	○	○	○	○	○	○		
PL 50	1000132	○	●	●	●	●	●	●	●	●	○	●	
PL 50 H heated[2])	1004806	○					●				○	●	
PL 51[2])	1001628	○									○		
PL 53	1000382	○	○	○	○	○	○	○	○	○	○	○	
PL 72	5304145	●											
PL 80	1003865		●	●	●	●	●	●	●	○	○	●	
P 250	5304812								●		●		
"Diamond Grade" reflective tape	4019634	○	●	●	●	●	●	●	○	○	○	○	

1) Reflective area equivalent to PL 30
2) Reflective area equivalent to PL 50

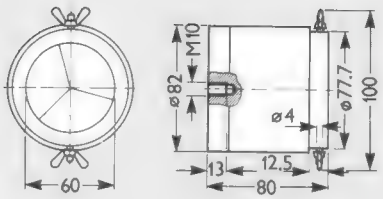
● with scanning distance details given in Technical Data
○ scanning distances on request



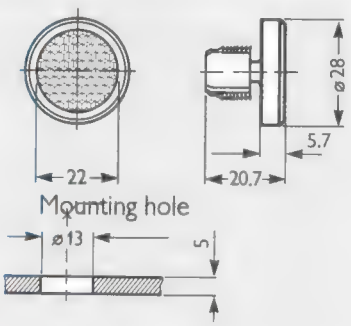
Reflector C 110 (Part No. 5304549)



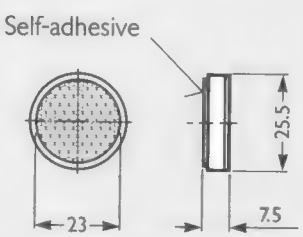
Reflective tape "Diamond Grade"
(Part No. 4019634)



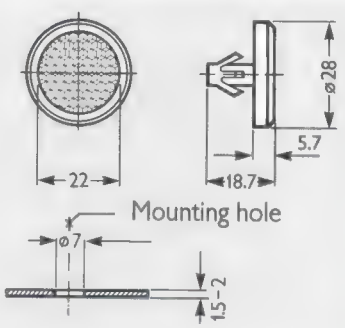
Reflector OP 61 (Part No. 1002627)
OP 60 (Part No. 1000141)



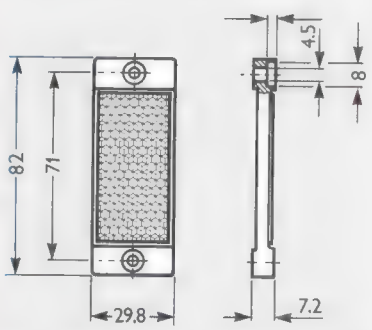
Reflector PL 22-1 (Part No. 1003546)



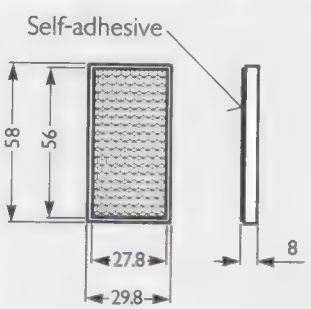
Reflector
PL 22-2 (Part No. 1003621)
PL 26 (Part No. 1001440)



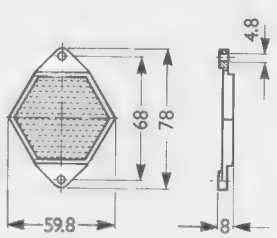
Reflector PL 22-3 (Part No. 1004488)



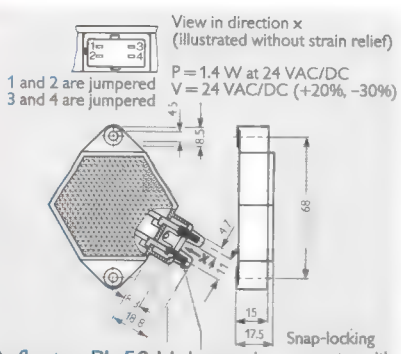
Reflector PL 30 (Part No. 1002314)



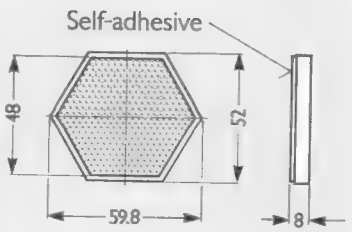
Reflector PL 31 (Part No. 1002315)



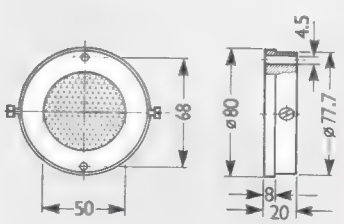
Reflector PL 50 (Part No. 1000132)



Reflector PL 50 H, heated
(Part No. 1004806)

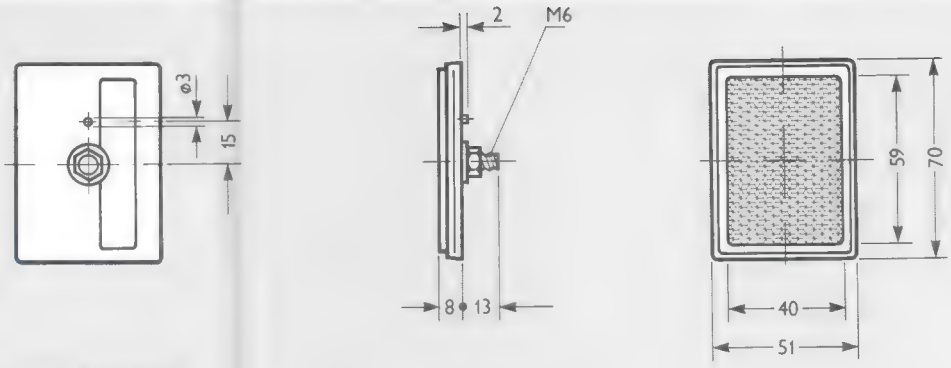


Reflector PL 51 (Part No. 1001628)

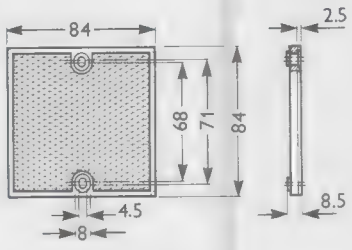


Reflector PL 53 (Part No. 1000382)
Reflector SW 50 (Part No. 1000131)

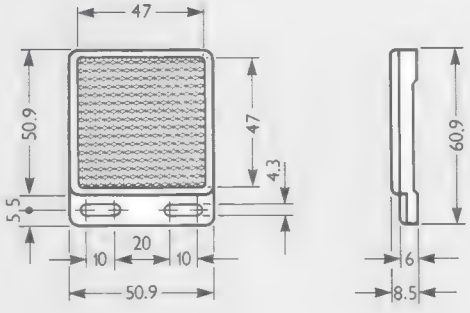
Accessories
Reflectors



Reflector PL 72 (Part No. 5304145)



Reflector PL 80 (Part No. 1003865)



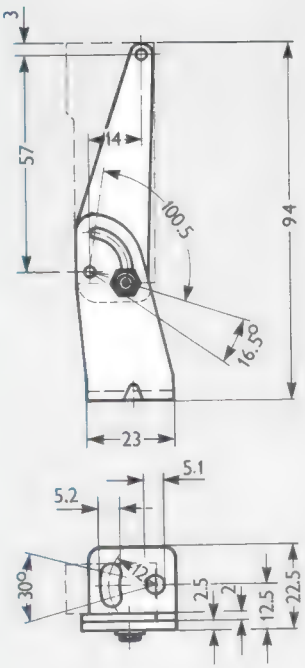
Reflector P 250 (Part No. 5304812)

Accessories
Mounting Brackets

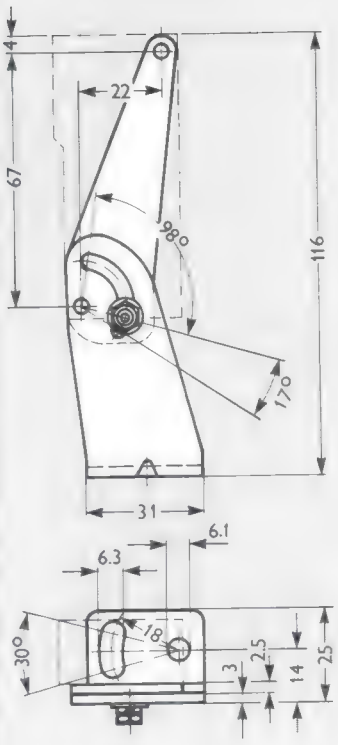
Description	Part No.	W 5-series	W 6-series	W 9-series	W 18-series	W 27-series	W 36-series	W 45-series	WT 32	WT 30	W 12-series	WLL 10	W 260-series	PFK 1	WL/WT 25 Exi	WSU/WEU 26
Mounting bracket	2009120			●												
Mounting bracket	2009317				●											
Mounting bracket	2009122					●										
Mounting bracket	2005806						●		●	●						
Angle bracket	2011480							●								
Ball-joint bracket	2011436							●								
Mounting bracket	4007744											●[1]				
Mounting bracket	4009080													●[1]	●[1]	
Articulated bracket	1003073											●				
Articulated bracket	1005580															
Articulated bracket	2006258															
Mounting bracket	2007900															●
Wall-mounting bracket	2010846															
Bracket for optic head	2002974															
Ball-joint bracket	2007004															
Mounting bracket	5304819												●[1]			
Mounting bracket											●[1]					
Fixing clamp											●[1]					

1) Included

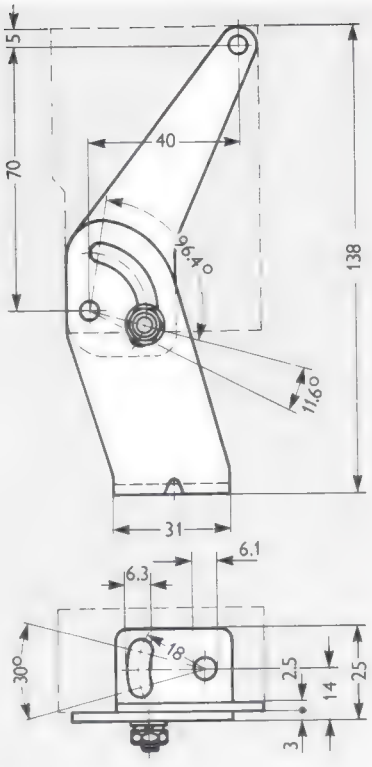
Accessories
Mounting Brackets



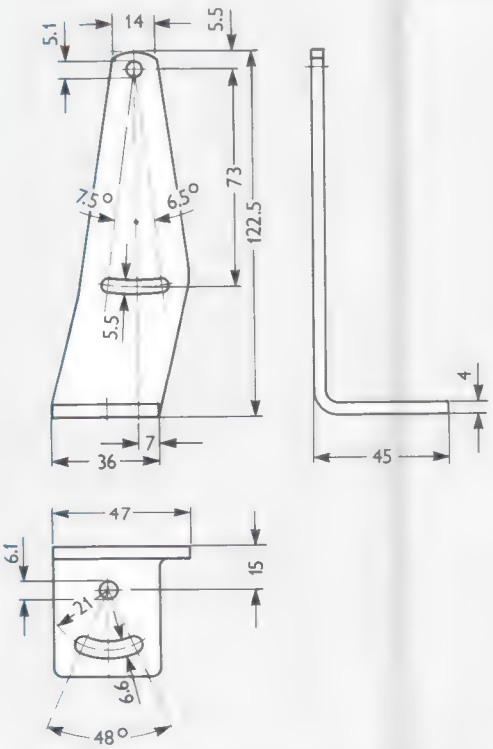
Mounting bracket
for W 9-series,
Part No. 2009120
(supplied unfitted)



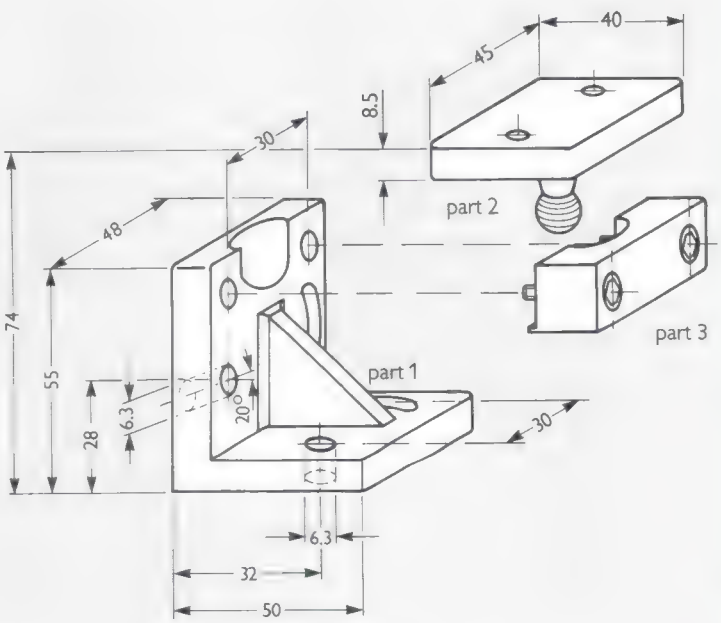
Mounting bracket
for W 18-series,
Part No. 2009317
(supplied unfitted)



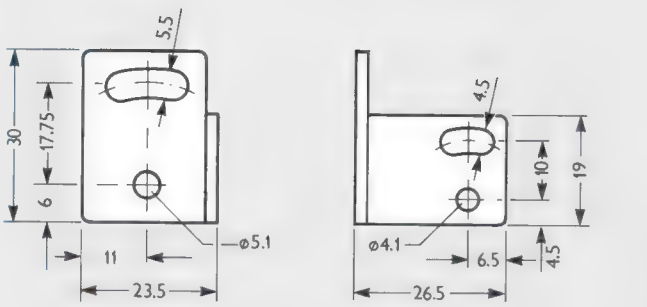
Mounting bracket
for W 27-series,
Part No. 2000122
(supplied unfitted)



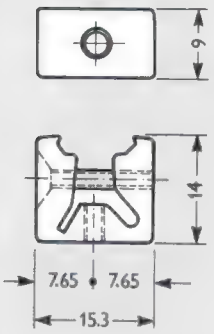
Mounting bracket for W 36-series, for W 32-series,
and W 30-series, Part No. 2005806



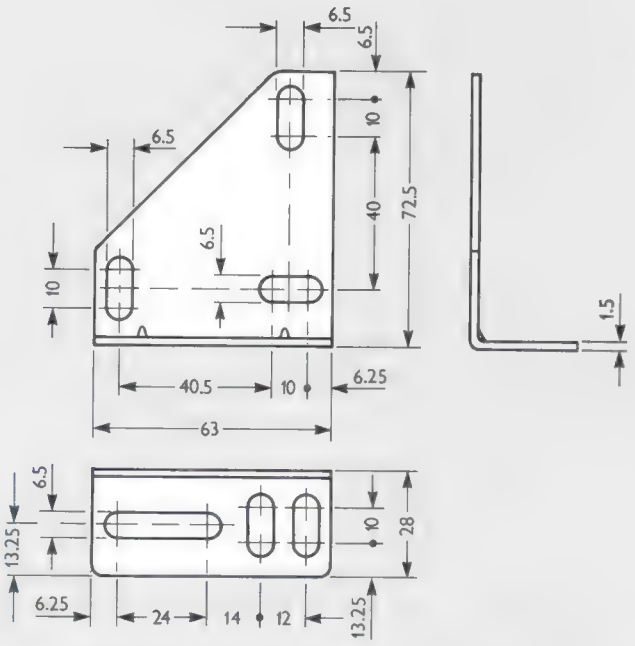
For W 45-series:
Angle bracket, Part No. 2011480 (part 1)
Ball-joint bracket, Part No. 2011436 (parts 1, 2 and 3)



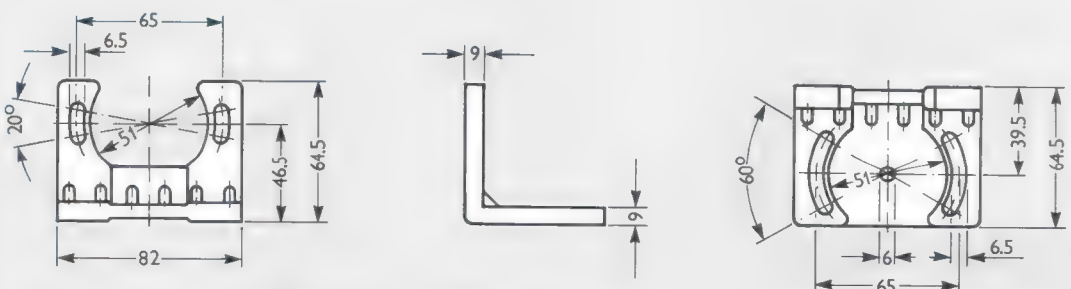
Mounting bracket for W 12-series



Fixing clamp for W 12-series
(2 pieces required)



Mounting bracket for W 260-series (Part No. 5 304 819)



Mounting bracket for PFK 1, Part No. 4 009 080
for WL/WT 25 Ex i, Part No. 4 009 080
for WSU/WEU 26, Part No. 2 007 900

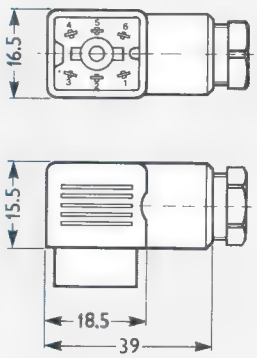
Accessories
Cable Receptacles

Accessories Cable Receptacles

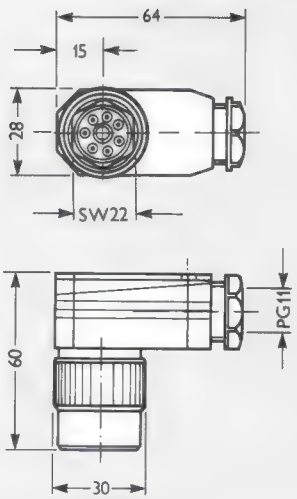
Description	Part No.	WL 18-N/-P 630	WT 18-N/-P 610	WS/WE 27-D/-N/-P 630	WS/WE 27-U/-R 630	WL 27-N/-P 630	WL 27-R	WT 27-N/-P 610	WT 27-R	WS/WE 36-D/-N/-P 630	WS/WE 36-U/-R 630	WL 36-B 330	WS/WE 36-B 430	WL 36-B 430	WT 36-B410	WL 36-B 730, WT 36-N/-P 710	WL 36-R 730, WT 36-R 710	WT 32-B 330	WT 32-B 630	WS/WE 12	WL 12	WL 12-B 5681	WT 12 VGA	WT 12 HGA	WT 12 energetic	WT 12-B 5781	VS/VE 180 (DC)	VS/VE 180 (AC)	VL 180 (DC)	VL 180 (AC)	VT 180 (DC)	VT 180 (AC)
Cable receptacle, 6-pin (DC)	6006710	●	●	●		●		●																								
2m cable with receptacle and crimped leads	2009477	●	●	●		●		●																								
3m cable with receptacle and crimped leads	2009478	●	●	●		●		●																								
5.5m cable with receptacle and crimped leads	2009479	●	●	●		●		●																								
10m cable with receptacle and crimped leads	2009480	●	●	●		●		●																								
Cable receptacle, 6-pin (AC/DC)	6006685				●		●		●																							
2m cable with receptacle and crimped leads	2009116				●		●		●																							
3m cable with receptacle and crimped leads	2009117				●		●		●																							
5.5m cable with receptacle and crimped leads	2009118				●		●		●																							
10m cable with receptacle and crimped leads	2009119				●		●		●																							
Cable receptacle, 4-pin, to DIN 43650	6005698											●							●													
Cable receptacle, right angle, 7-pin, to DIN 43651	6006613									●	●									●												
Cable receptacle, straight, 7-pin, to DIN 43651	6006612									●	●									●												
Cable receptacle, 7-pin (DC)	6006823															●																
Cable receptacle, 7-pin (AC/DC)	6006821																●															
Cable receptacle, right angle, 4-pin (DC)	6007303												●	●	●						●	●		●	●	●	●	●		●		●	
Cable receptacle, straight, 4-pin (DC)	6007302												●	●	●						●	●		●	●	●	●	●		●		●	
Cable receptacle, right angle, 4-pin (AC)	6007306																												●		●		●
Cable receptacle, straight, 4-pin (AC)	6007305																												●		●		●
Cable receptacle, right angle, 5-pin	6008900																					●										
Cable receptacle, straight, 5-pin	6008899																					●										
Cable receptacle, right angle, 7-pin	6007301																															

Dimensions in mm

For cable diameters from 4 to 7.8 mm

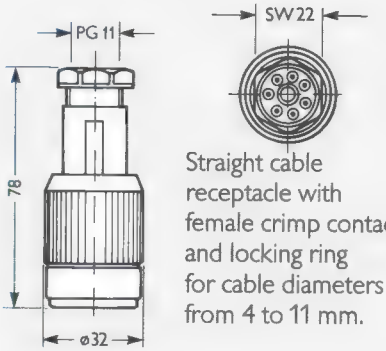


Part No. 6006710 **(DC)**
and 6006685 **(AC)**



Right-angle cable receptacle with female crimp contacts and center screw for cable diameters from 4 to 11 mm.

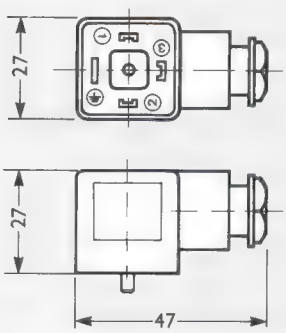
Part No. 6006613



Straight cable receptacle with female crimp contacts and locking ring for cable diameters from 4 to 11 mm.

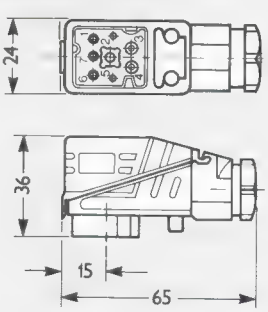
Part No. 6006612

For cable diameters from 6 to 8 mm



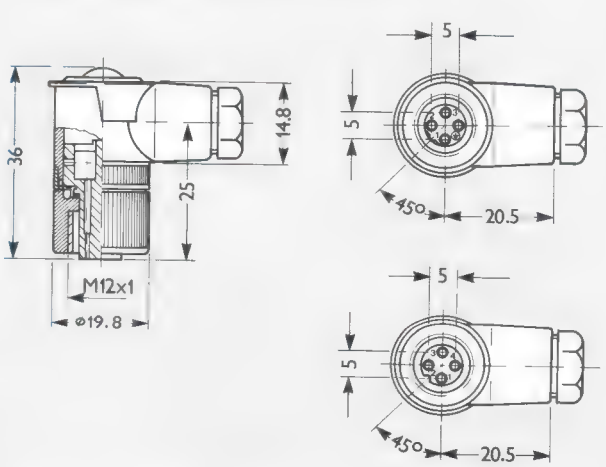
Part No. 6005698

For cable diameters from 5 to 11 mm



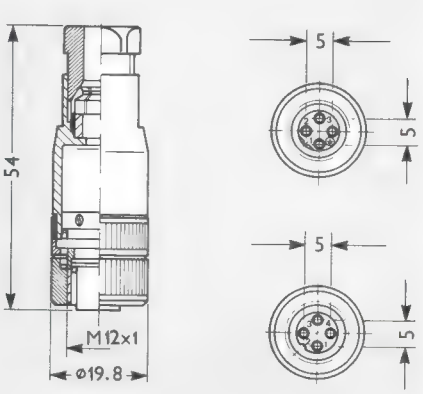
Part No. 6006821 **(AC/DC)**
and 6006823 **(DC)**

For cable diameters from 4,5 to 6,5 mm



Part No. 6007303 **(AC/DC)**
and 6007306 **(AC)**

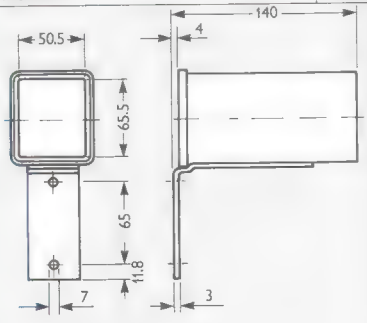
For cable diameters from 4,5 to 6,8 mm



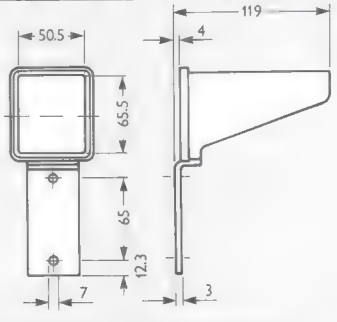
Part No. 6007302 **(AC/DC)**
and 6007305 **(AC)**

Selection Table
Special Accessories

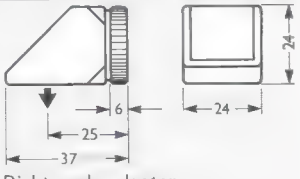
Description	Part No.	VS/VE 18	VL 18	VT 18	WSU/WEU 26	W 25-series	PL 50	Flange	Air-purging attachment	W 45-series	W 36-series	WT 30	WL 32, WT 32
Right-angle adapter	1009707	●											
Right-angle adapter	1005389		●										
Right-angle adapter	1005390			●									
Snow shield	1003619				●	●							
Dust shield	1003556				●	●							
Flange	1000130						●						
Air-purging attachment	1000309						●						
Snow shield	4001068						●						
Dust shield 90 mm	1000252							●					
184 mm	1000134							●					
314 mm	1000133							●					
Dust shield 130 mm	1001985								●				
224 mm	1001961								●				
320 mm	1001960								●				
Snow shield	2011431									●			
Dust shield	2011432									●			
Heat sink	2011435									●			
Lens heater	1004805										●	●	●



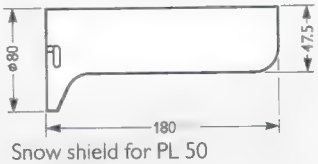
Dust shield for WSU/WEU 26
(Part No. 1003556)



Snow shield for WSU/WEU 26
(Part No. 1003619)

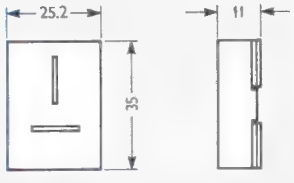


Right-angle adapter
Part No. 1005389 (VL 180)
Part No. 1005390 (VT 180)
Part No. 1009707 (VS/VE 180)

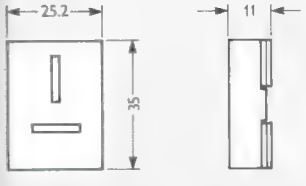


Snow shield for PL 50
(Part No. 4001068

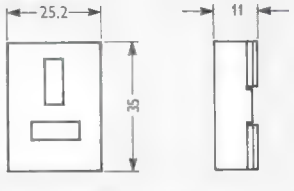
BL 100



BL 200



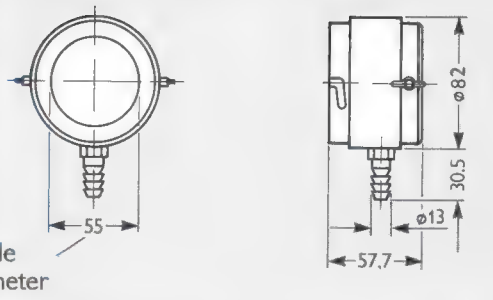
BL 500



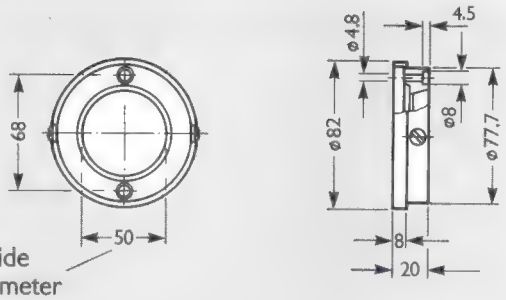
Slotted mask	Slot width	Scanning distance	Part No.
BL 500	5 mm	6 m	5304811
BL 200	2 mm	3 m	5304810
BL 100	1 mm	1,5 m	5304809

Slotted masks (accessories) are available to detect small objects or to increase the operating precision. The slotted mask should be mounted so that the top slot is perpendicular to the travelling direction of the object to be detected. For use with WS/WE 260.

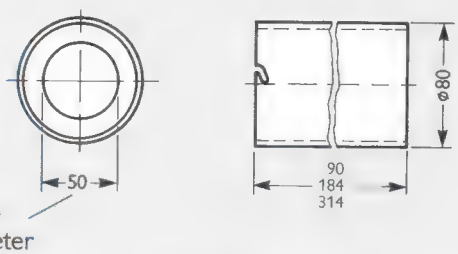
Dimensions in mm



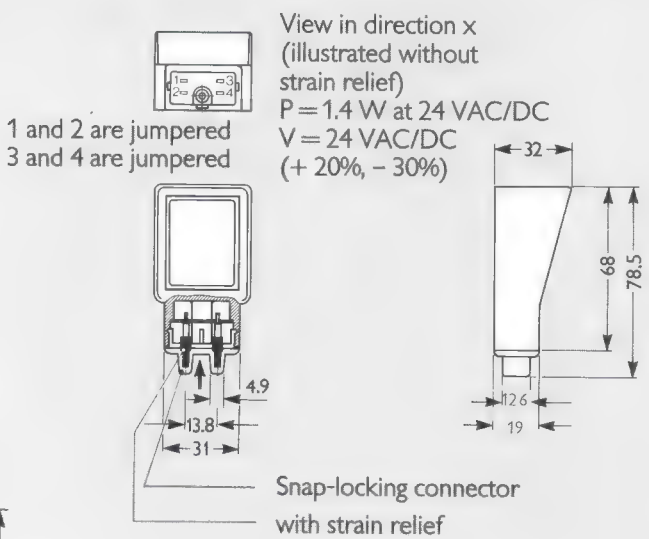
Air-purging attachment for PL 50 (Part No. 1 000 309) (only with flange)



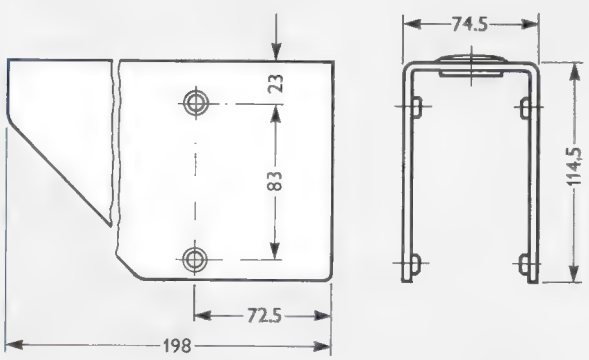
Flange for dust shield, snow shield and air-purging attachment on PL 50 (Part No. 1 000 130)



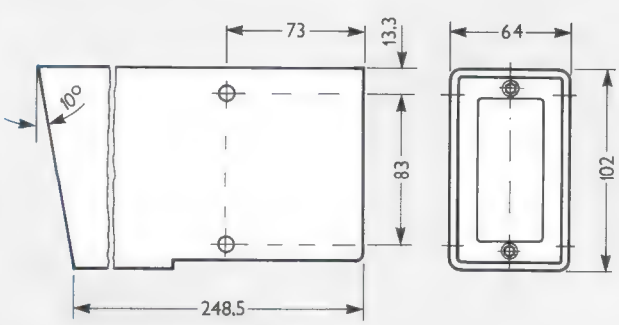
Dust shield for use with flange
90 mm long (Part No. 1 000 252)
184 mm long (Part No. 1 000 134)
314 mm long (Part No. 1 000 133)



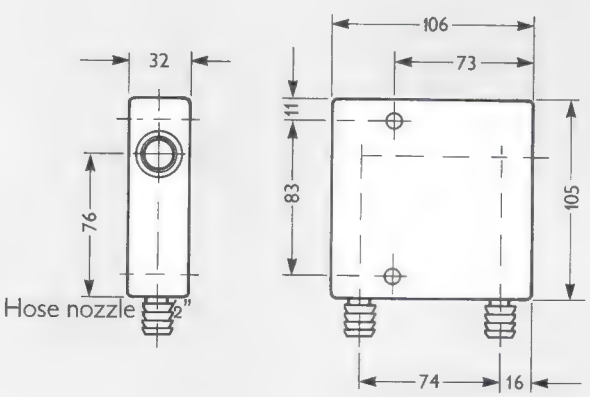
Lens heater (Part No. 1 004 805)



Snow shield for 45-series
(Part No. 2 011 431)

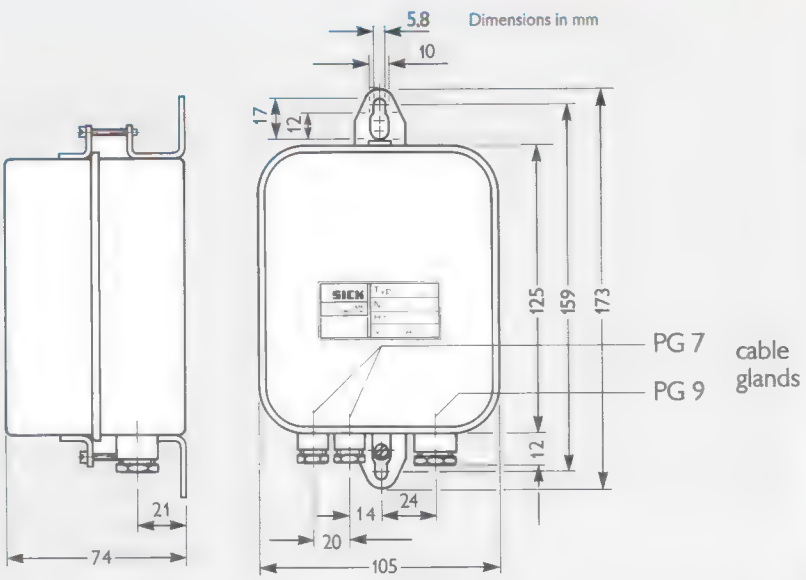


Dust shield for W 45-series
(Part No. 2 011 432)

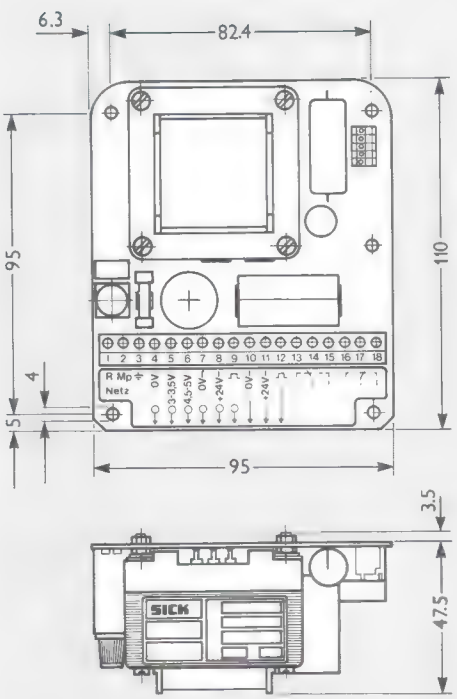


Cooling plate for W 45-series
(Part No. 2 011 435)

NP 06/08



BP 06/08

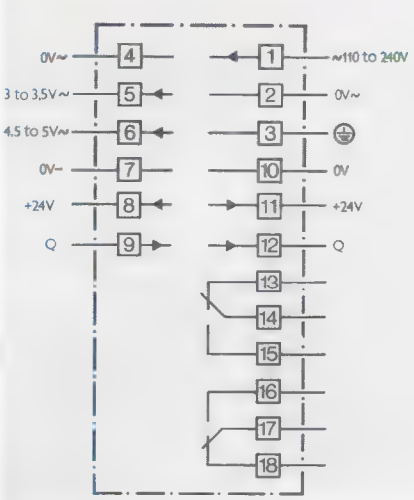


NP/BP	NP 06	NP 08	BP 06	BP 08
Part No. with enclosure	1 002 889	1 002 890	–	–
without enclosure	–	–	1 002 886	1 002 887
Supply voltage V_S	110/120/220/240 VAC (+10%, –15%)			
Set at works at	220 VAC (+10%, –15%)			
Line frequency	48 to 62 Hz			
Power consumption max.	15 VA			
Output voltage	24 VDC			
Output current max.[1])	200 mA			
Ripple voltage	<3 V_{pp}			
Supply voltage (sender lamp)	1.5; 3; 3.5; 4; 5 VAC with fine adjustment			
Switching outputs	DPDT			
Switching voltage max.	250 V			
Switching current max.	3 A			
Switching power max.[2])	750 VA (50 W[3]), 120 W[4]))			
Response time (only relay)	<15 ms			
Drop-out time (only relay)	<20 ms			
Triggering time, min.	–	0.5 ms	–	0.5 ms
Time delay	–	fixed setting[5])	–	fixed setting[5])
Enclosure rating	IP 54		IP 00	
Ambient operating temperature	–20 to +65 °C			
Storage temperature	–40 to +70 °C			
Weight	approx. 1.1 kg		approx. 0.7 kg	

1) Without using relay; 160 mA when using relay
2) Provide suitable arc suppression with inductive or capacitive loads
3) At 250 VDC and with resistive load
4) At 40 VDC and with resistive load
5) Relay hold time: min. 20 ms, max. 80 ms

Connection Diagram

NP/BP 06, NP/BP 08

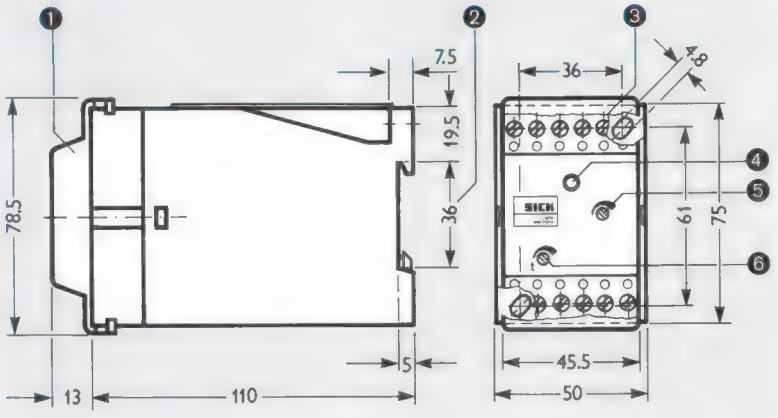


Features

- Adjustable switching mode
- Status indicator
- Retrofittable timing element
- Adjustable time delay (20 turn helipot)
- Choice of ON-delay or OFF-delay
- Triac triggering with no-voltage switch (KN 1-2...)
- Housing for snap fixing to 35 mm track to DIN 46277
- Housing flange for direct wall mounting; fixing dimensions to DIN 43604

KN 1

Dimensions in mm



1. Transparent cover (accessories)
2. Mounted on 35 mm track to DIN 46277
3. Connection terminals, clamping area 2 x 2.5 mm²
4. Status indicator
5. Lamp brightness
6. Time delay

Selection Table

Model	Part No.	Time delay	Supply voltage
KN 1-102	1003280	none	220 VAC
KN 1-112	1003278	0.015 to 0.5 s	220 VAC
KN 1-122	1003279	0.06 to 2 s	220 VAC
KN 1-132	1003274	0.5 to 16 s	220 VAC
KN 1-142	1003559	4 to 128 s	220 VAC
KN 1-101	1003282	none	120 VAC
KN 1-111	1004929	0.015 to 0.5 s	120 VAC
KN 1-121	1004192	0.06 to 2 s	120 VAC
KN 1-131	1003283	0.5 to 16 s	120 VAC
KN 1-125	1004656	0.06 to 2 s	120 VAC
KN 1-106	1003832	none	110 VAC
KN 1-136	1004491	0.5 to 16 s	110 VAC
KN 1-108	1004373	none	48 VAC
KN 1-138	1004369	0.5 to 16 s	48 VAC
KN 1-109	1004692	none	24 VAC
KN 1-129	1005509	0.5 to 16 s	24 VAC
KN 1-202	1003281	none	220 VAC
KN 1-212	1004557	0.015 to 0.5 s	220 VAC
KN 1-222	1003841	0.06 to 2 s	220 VAC
KN 1-232	1004531	0.5 to 16 s	220 VAC
KN 1-201	1004130	none	120 VAC

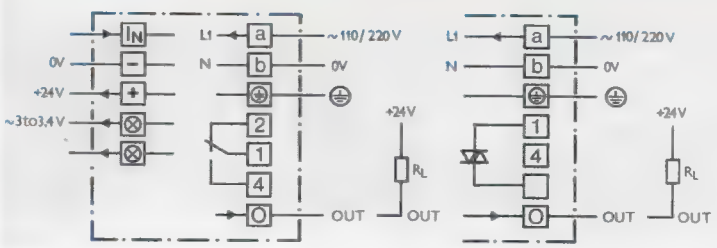
KN 1
Switching Amplifier

KN 1	-1	-2
Supply voltage V_S	see Selection Table	
Line frequency	50/60 Hz	
Power consumption	approx. 6 VA	
Output voltage (amplifier)	24 VDC, unstabilized	
Ripple voltage	2.5 V	
Output current max.	80 mA	
Output voltage (sender lamp)	3 VAC	
Output current max.	0.9 A	
Switching outputs[1])	inverting/non-inverting, selected with switch S2	
Relay output	SPDT	–
Switching voltage max.	250 V	–
Switching current max.	4 A	–
Switching power max.[2])	1000 VA	–
At 24 VDC, max.	100 W	
Switching frequency max.[3])	10/s	–
Triac output		
Switching voltage min.	–	48 VAC, –20%
Switching voltage max.	–	240 VAC, +10%
RMS current min.	–	0.06 A
RMS current max.	–	1 A
Peak current max.	–	6 A for 10 ms
Transistor output		
Output voltage HIGH	approx. 24 V (V_S)	
Output voltage LOW	≤1 V (with 10 mA output current)	
Output current max.	10 mA	
Time delay	plug-in	
Time-related behaviour[4])	ON-delay or OFF-delay, selected with slide switch S1	
Time range	see Selection Table	
Enclosure rating Housing	IP 40	
Terminals	IP 00	
Weight without time delay	330 g	
with time delay	345 g	

1) Switch S2 on mother board
2) Provide suitable arc suppression with inductive or capacitive loads
3) No time delay
4) Switch S1 on "Time delay" PCB

Connection Diagram

KN 1-1 **-2**



158 | NT 8 registration control scanner controlling register marks on blister packs

Contrast Scanners

The Use of Contrast Scanners

Contrast scanners work on the same principle as photoelectric proximity switches and are able to differentiate up to 15 degrees of gray on the black-to-white scale. This property is a prerequisite for reading contrast marks, e.g. colored print. Colours differ in most cases in their gray-scale values (brightness values). The readability of a mark is governed by the difference in brightness between mark and background, not the colour contrast.

Mode of Operation

A light source (LED or incandescent lamp) produces a light spot at the focal plane (scanning distance). The reflectance of this area is evaluated in the registration control scanner. The brightness value of the material surface (actual value) is continuously compared with a given threshold value (gray-scale value). As soon as the value exceeds or drops below the switching threshold, the switching output changes its status:

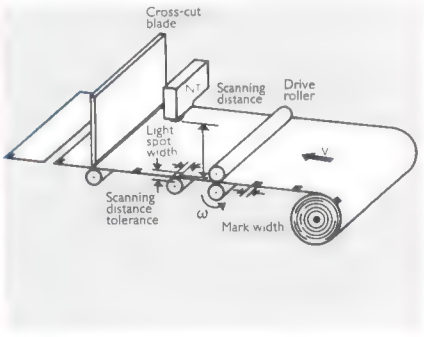


Fig. 1. A contrast scanner on a register mark-controlled cross- cut knife.

Fields of Application

Contrast scanners are used chiefly in the packaging industry for the register-controlled cutting of labels or packaging material (Fig. 1). Other fields of application include the positioning of cans and tubes, sorting using colored marks, positioning labels, code recognition, monitoring adhesive points (with fiber-optic models for through-beam applications), and checking the presence of "Consume by" dates.

Scanning Distance

The scanning distance is the distance between the objective lens of the contrast scanner and the surface of the material. In this instance it is also the focal plane distance at which the light spot is reproduced on the material. Requirements relating to the accuracy of material delivery are governed by the scanning distance tolerance. This tolerance indicates the limits within which the scanning distance can vary in service without affecting the measured actual gray-scale value. With large scanning-distance tolerances it is impossible to distinguish small differences in brightness. When fiber-optic cables are used, a precise light spot reproduction is not achieved: the light leaves the fiber-optic cable undirected, in the form of a disperse beam (Fig. 2). The scanning distance may vary when using fiber-optic cables, and the sensitivity of the system is reduced as the distance becomes greater. The size of the light spot is similarly a function of the scanning distance and can be determined from the light beam cross-section and the scanning distance.

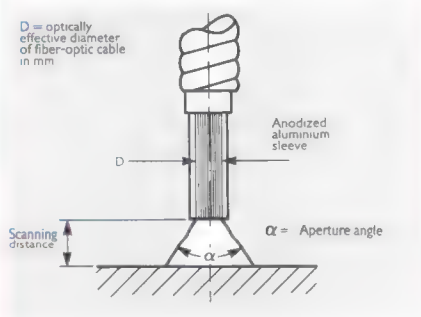


Fig. 2. The light leaves the fiber-optic cable undirected.

The switching accuracy which can be achieved is governed by the size of the light spot. The mark width required is a function of the size of the light spot and of the feed speed. The light spot should be parallel to the long side of the mark, so that the mark passes through the complete light spot.

Light Source

Depending on the various applications involved, different light sources are used in contrast scanners: red and green light-emitting diodes, infrared diodes and incandescent filament lamps. Light-emitting diodes emit a narrow- band light spectrum: with a red light-emitting diode, for example, a white/red contrast cannot be detected. Contrast scanners incorporating LEDs are consequently fitted with switch- selectable red and green, or plug-in LED modules. Incandescent filament lamps emit a considerably wider spectrum and are consequently capable – possibly with appropriate filters – of distinguishing many color contrasts (Fig. 3).

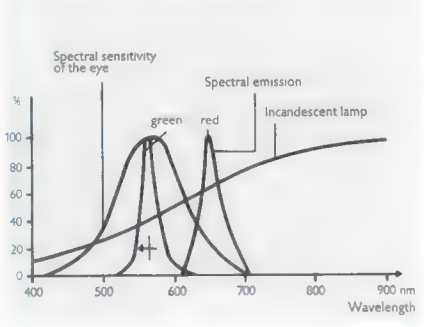


Fig. 3. Spectral distribution of green and red LEDs and of an incandescent lamp, compared with the sensitivity of the eye.

Two drawbacks are the considerably shorter life and the separate voltage supply required for the incandescent lamp. Contrast scanners incorporating fiber-optic cables are fitted with red and infrared diodes. Red light detects common markings; infrared is suitable amongst other things for detecting points of adhesion (with fiber-optic model in 2-tip configuration).

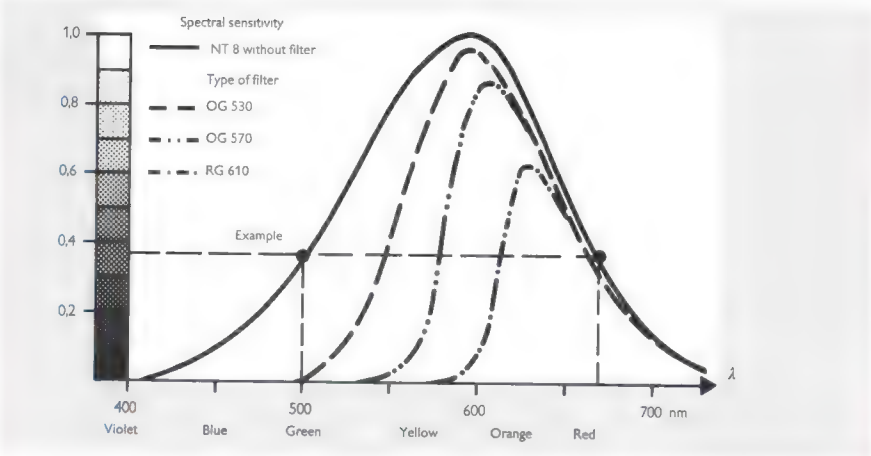


Fig. 4. Spectral sensitivity of light receiver in the NT 8, with and without filter.

Light Receiver

Compared with the spectral sensitivity of the eye, the spectral sensitivity of the receiver is slightly displaced in the red direction (Fig. 4). Figs. 3 and 4 show that, with white light, a contrast scanner usually interprets the colours red and green with a similar gray- scale value. With red light, on the other hand, a red mark reflects the incident light, whereas green absorbs the red light.

Supply Voltage

The supply voltage of the contrast scanner is reverse-polarity protected and can vary between the limits 10 V and 30 V. Contrast scanners with incandescent lamps require an additional supply voltage for the lamp. The voltage specified should be maintained as accurately as possible. While a lower voltage extends the life of the lamp, even slightly exceeding the voltage will considerably reduce lamp life.

Switching Outputs

Electronic switching outputs are available in NPN and PNP configurations. The electronic B output replaces both these alternatives: the type of output is then determined only by the load being connected to +V (NPN configuration) or 0 V (PNP configuration). The devices are suitable for light-switching and dark-switching modes. In the case of light-switching, current flows through the load for a light mark; with dark-switching this applies to a dark mark. The switching threshold can be adjusted with a multi-turn potentiometer, whose mode of operation is illustrated in Fig. 5.

Light switching

Mark	Status indicator	B output			PNP output		NPN output	
		Output Q	Relay P	Relay N	Output Q	Relay P	Output Q	Relay N
Dark	Goes off	HIGH (active)	pulled in	dropped out	LOW	dropped out	HIGH	dropped out
Light	Lights up	LOW (active)	dropped out	pulled in	HIGH (active)	pulled in	LOW (active)	pulled in

Dark switching

Mark	Status indicator	B output			PNP output		NPN output	
		Output Q	Relay P	Relay N	Output Q	Relay P	Output Q	Relay N
Dark	Lights up	LOW (active)	dropped out	pulled in	HIGH (active)	pulled in	LOW (active)	pulled in
Light	Goes off	HIGH (active)	pulled in	dropped out	LOW	dropped out	HIGH	dropped out

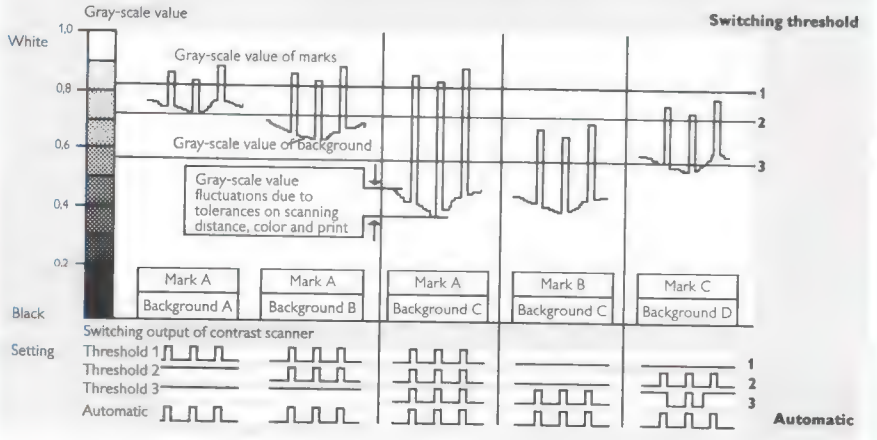


Fig. 5. Manual and automatic setting of switching threshold, and response at switching output.

Switching Frequency

The maximum switching frequency is obtained from the response time and release time:

$$f_{max} = \frac{1}{t_{resp} + t_{rel}}$$

f_{max} = maximum switching frequency
t_{resp} = response time
t_{rel} = release time

Response Time

The response time determines the maximum material speed. The reaction distance can be estimated from the response time and the material speed:

$s = v \cdot t_{res}$

s = reaction distance
v = material speed
t_{res} = response time

Timing Element

The timing elements indicated represent the minimum time-element, i.e. at each mark the output signal is extended time-wise by the minimum time indicated.

Analog Output

The analog output can be used for contrast evaluation. The output voltage corresponds to the current gray-scale value.

 NT 6 scanners (customized versions) on a drinks-filling machine controlling container position prior to filling and cutting

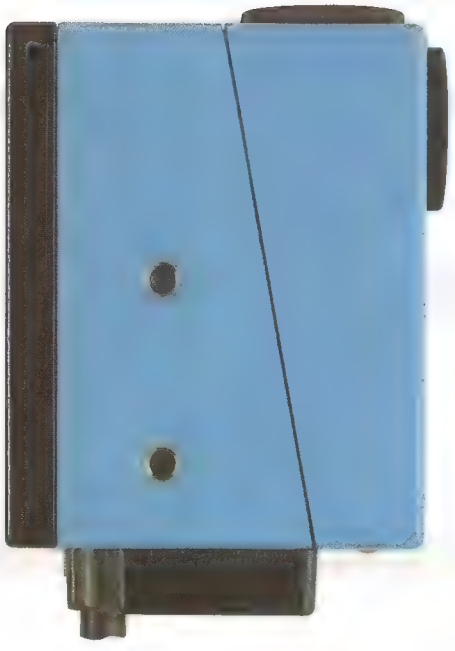
NT 6, NTA 6, NTL 6, NT 8
Contrast Scanners

NT 6

NTA 6

NTL 6

NT 8



Contrast scanners in diecast metal housing. Interchangeable lenses for scanning distances from 9 to 18 mm. Supply voltage range 10 to 30 V (lamp voltage on NT 8: 4.5 V). Status indicator.

High switching frequency of up to 10,000/s. Adjustable switching threshold. PNP, NPN and B outputs, short circuit protected. Modulated-light operation (not on NT 8), thereby largely insensitive to ambient light. Enclosure rating IP 67 (dusttight, watertight).

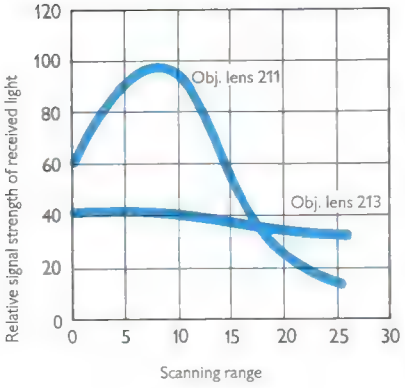
NTA 6 with automatic sensitivity adjustment. NTL 6 for fiber-optic cable connection (200 to 1500 mm). NT 8 to detect very small contrasts. Various light spot positions. White, red, green and infrared light sources.

Scanning Distance

9 and 18 mm

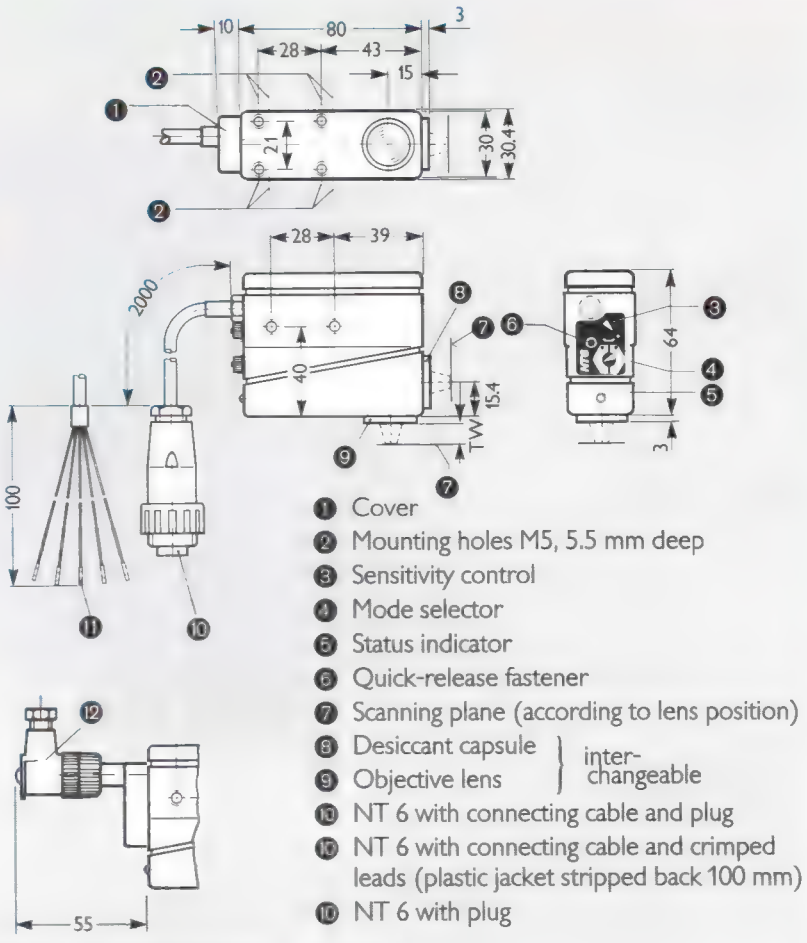
Features

- LED light source with two switch-selectable spectral ranges
- Changeable lens position
- Supply voltage reverse-polarity protected
- Insensitive to ambient light
- Light- or dark-switching, switch-selectable
- Status indicator
- Switching frequency up to 10,000/s
- Analog output
- Short response time
- Remote control and timing elements possible
- Semi-automatic switching-threshold adjustment
- Die-cast metal housing



NT 6

Dimensions in mm

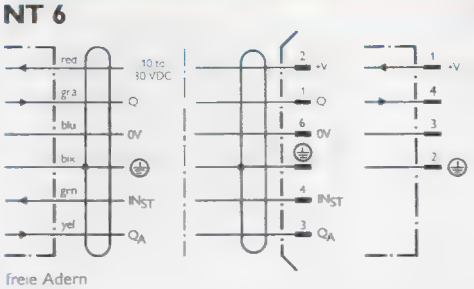


1. Cover
2. Mounting holes M5, 5.5 mm deep
3. Sensitivity control
4. Mode selector
5. Status indicator
6. Quick-release fastener
7. Scanning plane (according to lens position)
8. Desiccant capsule } interchangeable
9. Objective lens } interchangeable
10. NT 6 with connecting cable and plug
11. NT 6 with connecting cable and crimped leads (plastic jacket stripped back 100 mm)
12. NT 6 with plug

Mode selector				
Mode	light-switching		dark-switching	
Sender diode	red	green	red	green

Connection Diagram

NT 6



red	gra	blu	blk	grn	yel
red	gray	blue	black	green	yellow

NT 6
Contrast Control Scanner

NT 6				
Part No.	see Selection Table			
Scanning distance	scanning distance	scanning dist. tolerance	light spot dimensions	
			green	red
With lens No. 211 (Part No. 1 004 936)	9 mm	± 2 mm	1.5 x 5 mm²	1.5 x 4 mm²
With lens No. 213 (Part No. 2 009 266)	18 mm	± 2 mm	2 x 8 mm²	2 x 7 mm²
Supply voltage V_S	10 to 30 VDC[1])			
Current consumption (no load)	≦80 mA			
Ripple[2])	≦5 V_{PP}			
Light source	LED, average service life 100,000 h[3])			
Light wavelength	650 nm (red), 560 nm (green), switch-selectable			
Modulation frequency	approx. 200 kHz			
Light spot orientation	lengthwise or transverse to short side of device			
Light receiver				
Wavelength	450 to 750 nm (visible light)			
Switching output	light- or dark-switching, switch-selectable			
Type	B (=Q_B=NPN and PNP)	PNP		
Output voltage HIGH	V_S – ≦2 V	V_S – ≦2 V		
Output voltage LOW	≦2 V	0 V		
Output current max.	200 mA	200 mA		
Pull-up / pull-down resistance	22 kΩ	22 kΩ		
Response time; switching frequency[4])	max. 50 µs; max. 10,000/s			
Analog output (Ri = 10 kΩ)	approx. 0.15 to approx. 6 V (no reflection to total reflection)			
Enclosure rating	IP 67			
Ambient operating temperature	0 to +50 °C			
Storage temperature[5])	–25 to +75 °C			
Connecting cable	2 m, 4x0.34 mm², shielded, PVC, O.D. 6 mm (5x0.34 mm² for remote control)			
Weight	approx. 540 g			

1) Limit values; reverse-polarity protected
2) Must be within V_S tolerances
3) At room temperature = +25 °C
4) With light/dark time ratio of 1:1; no time delay
5) Do not distort cable below 0 °C

Selection Table (with objective lens No. 211)

Part No.	Model	Light spot orien.	Output	Options	Cable plug
1 005 821	NT 6-03 012	vertical	B	–	●
1 005 822	NT 6-03 022		B	–	–
1 005 823	NT 6-13 012	horizontal	B	–	●
1 005 824	NT 6-13 022		B	–	–
1 006 474	NT 6-04 012	vertical	PNP	–	●
1 006 475	NT 6-04 022		PNP	–	–
1 005 829	NT 6-08 012		PNP	15 ms delay	●
1 005 830	NT 6-08 022		PNP	15 ms delay	–
1 005 825	NT 6-07 012		PNP	50 ms delay	●
1 005 826	NT 6-07 022		PNP	50 ms delay	–
1 005 051	NT 6-00 215		NPN	remote control	cable, 5 m long
NT 6 with 4-pin connector plug, without cable, suitable for explosion protection zone 2:					
1 006 367	NT 6-03 018	vertical	B	–	with 4-pin plug
1 007 478	NT 6-04 018		PNP	–	

Scanning Distance

0 to 15 mm

0 to 60 mm

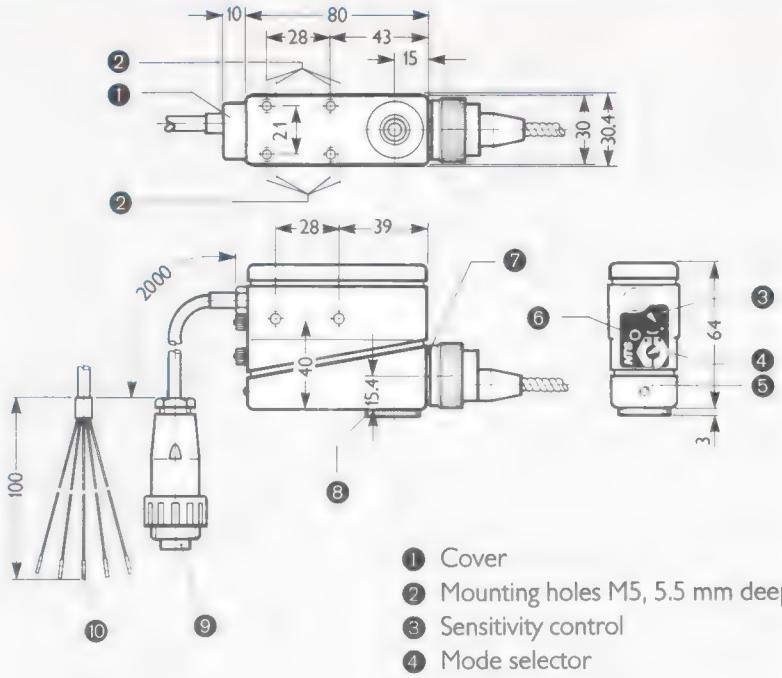
Features

- 200, 500, 1000, 1300 and 1500 mm fiber-optic cables available
- Fiber-optic cables for through-beam and proximity applications
- 40 mm minimum bending radius
- Light source with two switch-selectable spectral ranges
- Short response time
- Supply voltage reverse-polarity protected
- Semi-automatic switching threshold adjustment
- Insensitive to ambient light
- Light- or dark-switching, switch-selectable
- Status indicator
- Switching frequency up to 10,000/s
- Analog output
- Die-cast metal housing

Mode selector				
Mode	light-switching		dark-switching	
Sender diode	red	IR	red	IR

NTL 6

Dimensions in mm

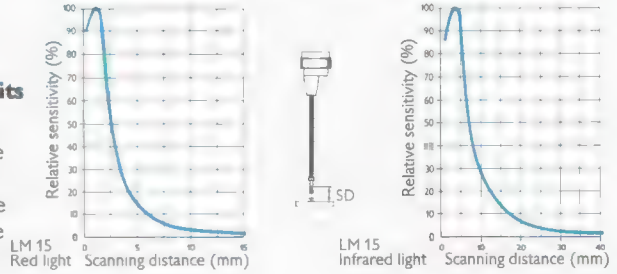


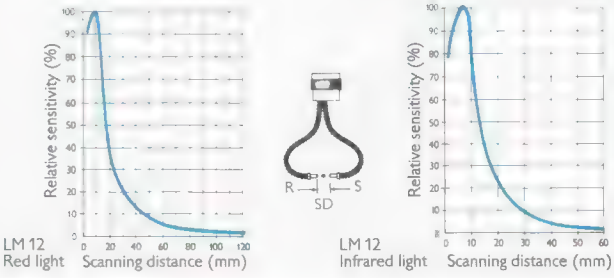
1. Cover
2. Mounting holes M5, 5.5 mm deep
3. Sensitivity control
4. Mode selector
5. Status indicator
6. Quick-release fastener
7. Fiber-optic cable connector
8. Desiccant capsule
9. Connecting cable with plug
10. Connecting cable without plug; cable with crimped leads (plastic jacket stripped back 100 mm)

Scanning ranges, limits

As reliable functioning makes a safety allowance necessary, the scanning distances indicated in the data sheet should not be exceeded. The curves illustrate the optimal scanning distances.

Based on White standard (DIN 5033)





NTL 6 Contrast Scanner with Fiber-optic Cables

NTL 6		
Part No.	see Selection Table	
Scanning distance[1] (1-tip config.)	(red)	(infrared)
Fiber-optic cables LM 15, 16, 17, 18, 21	0.5 to 5 mm	0 to 15 mm
Scanning distance (2-tip configuration)		
Fiber-optic cables LM 12, 18, 22	0 to 20 mm[2]	0 to 60 mm
Supply voltage V_S	10 to 30 VDC[3]	
Current consumption (no load)	≦80 mA	
Ripple[3]	≦5 V_{pp}	
Light source	LED, average service life 100,000 h[4]	
Light wavelength	650 nm (red), 920 nm (infrared), switch-selectable/fiber-optic cable plug-selectable	
Modulation frequency	approx. 200 kHz	
Light spot orientation	depending on fiber-optic cable used	
Light receiver		
Wavelength	450 to 920 nm	
Switching output	light- or dark-switching, switch-selectable	
Type	B (= Q_B = NPN and PNP)	
Output voltage HIGH	V_S – ≦2 V	
Output voltage LOW	≦2 V	
Output current max.[5]	200 mA	
Pull-up / pull-down resistance	22 kΩ	
Response time; switching frequency[6]	max. 50 µs; max. 10,000/s	
Analog output (R_l = 10 kΩ)	approx. 0.3 to approx. 6 V (no reflection to total reflection)	
Enclosure rating	IP 67	
Ambient operating temperature	0 to +50 °C	
Storage temperature[7]	–25 to +75 °C	
Connecting cable	2 m, 4×0.34 mm², shielded, PVC, O.D. 6 mm	
Weight	approx. 540 g	

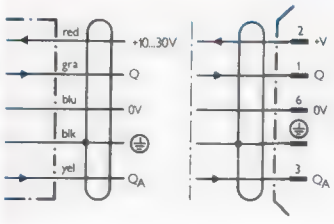
1) Based on white standard, to DIN 5033
2) Limit values; reverse-polarity protected
3) Must be within V_S tolerances
4) At room temperature = +25 °C
5) Short circuit proof
6) With light/dark time ratio of 1:1; no time delay
7) Do not distort cable below 0 °C

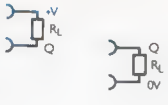
Selection Table

Part No.	Model	Switching output	Options	Cable plug
1008615	NTL 6-B11	B	–	●
1008616	NTL 6-B12	B	–	–
1009593	NTL 6-E11	PNP	15 ms minimum time	●
1009594	NTL 6-E12	PNP	15 ms minimum time	–

Connection Diagram

NTL 6 **NPN** **PNP**



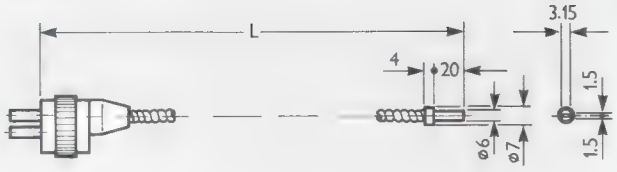


red	gra	blu	blk	yel
red	gray	blue	black	yellow
rot	grau	blau	schwarz	gelb

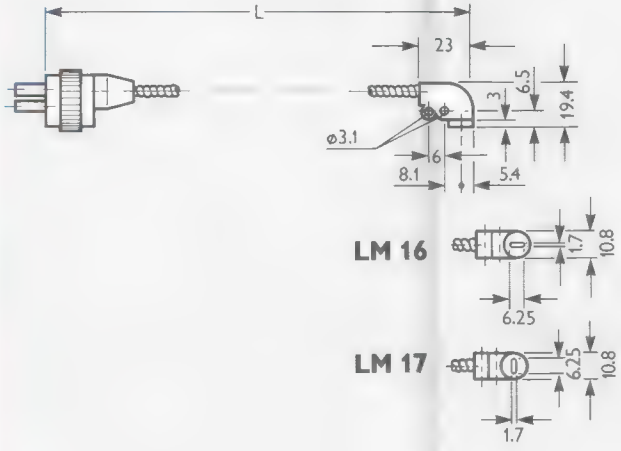
Fiber-optic Cables for NTL 6

LM 12

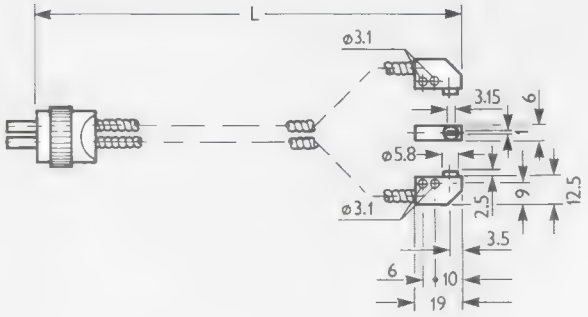
LM 15



LM 16 **LM 17**

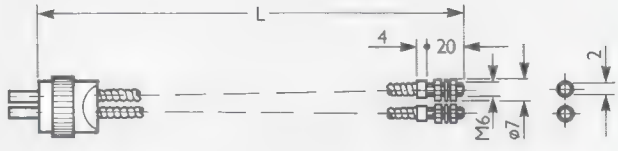


LM 18



LM 21

LM 22



Dimensions in mm

Selection Table for Fiber-optic Cables

Fiber-optic cable	LM 12	LM 15	LM 16	LM 17	LM 18	LM 21	LM 22
L = 200 mm, Part No.			2101101	2009815			
L = 500 mm, Part No.	2009843	2009844	2010040	2010074	2010822	2010914	2010915
L = 1000 mm, Part No.	2010912	2010913			2011597		
L = 1300 mm, Part No.					2011562		
L = 1500 mm, Part No.		2011149					
Optically effective diameter D	2 mm	1 x 3.15 mm²	1.7 x 6.25 mm²		1 x 3.15 mm²	2 mm	2 mm
Ambient operating temperature	−10 to +60 °C						
Armouring	Helical metal spring + PVC covering						
Minimum bending radius	40 mm						

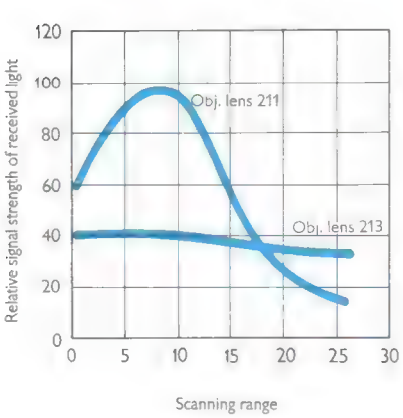
NT 6 scanners using printed marks to control proper fitting of seal and label on a champagne corking machine

Scanning Distance

9 and 18 mm

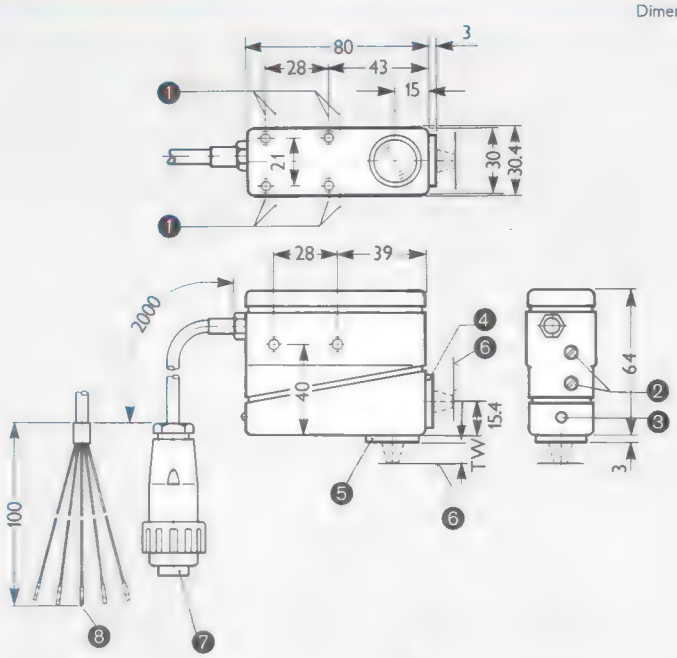
Features

- Automatic adjustment of switching threshold
- Changeable lens position
- Plug-in light source; two spectral ranges available; two light spot orientations (horizontal or vertical)
- Status indicator
- Supply voltage reverse-polarity protected
- Insensitive to ambient light
- Remote selection of light- or dark-switching mode
- Switching frequency up to 10,000/s
- Short response time
- Remote control of Enable/Inhibit blanking function and setting of background reference
- Die-cast metal housing



NTA 6

Dimensions in mm



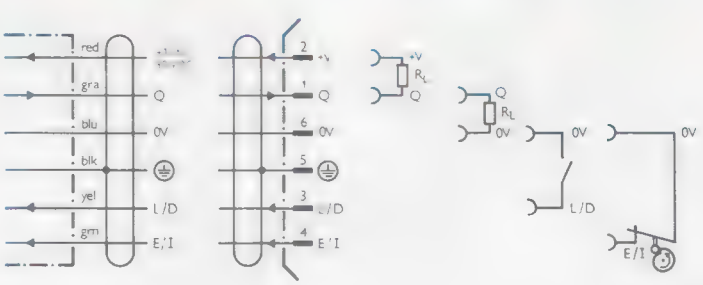
1. Mounting holes M5, 5.5 mm deep
2. Screw cap
3. Status indicator
4. Desiccant capsule
5. Objective lens

} interchangeable

6. Scanning plane (according t-o lens position at scanning distance)
7. NTA 6 with connecting cable and plug
8. NTA 6 with connecting cable but with no plug; cable with crimped leads (plastic jacket stripped back 100 mm)

Connection Diagram

NTA 6 **NPN** **PNP**



L/D = light/dark control wire

Control of Enable/ Inhibit blanking function and setting of background reference

red	gra	blu	blk	yel	grn
red	gray	blue	black	yellow	green

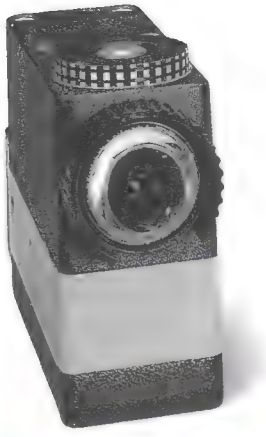
NTA 6 Contrast Scanner with Automatic Sensitivity Adjustment

NTA 6				
Part No.	see Selection Table			
Scanning distance	scanning distance	scanning dist. tolerance	light spot dimensions	
			green	red
With lens No. 211 (Part No. 1004936)	9 mm	±2 mm	1.5 x 5 mm²	2 x 4 mm²
With lens No. 213 (Part No. 2009266)	18 mm	±2 mm		2 x 7 mm²
Supply voltage V_S	10 to 30 VDC[1])			
Current consumption (no load)	≦90 mA			
Ripple[2])	≦5 V_{pp}			
Light source	LED, average service life 100,000 h[3])			
Light wavelength	650 nm (red) / 560 nm (green); plug-in			
Modulation frequency	approx. 200 kHz			
Light spot orientation	lengthwise or transverse to short side of device			
Light receiver				
Wavelength	450 to 750 nm (visible light)			
Switching output	remote selection of light- or dark-switching mode (L/D control wire)			
Type	B (NPN and PNP)			
Output voltage HIGH	V_S − ≦2 V			
Output voltage LOW	≦2 V			
Output current max.[4])	200 mA			
Pull-up / pull-down resistance	22 kΩ			
L/D control input: light-switching	7.5 V < $V_{L/D}$ < 30 V (not connected)			
L/D control input: dark-switching	<3 V			
Control input: pull-up resistance	6.8 kΩ			
Enable/Inhibit				
Inhibit (blanking)	$V_{E/I}$ ≦1 V			
Enable	5 V ≦ $V_{E/I}$ ≦ 30 V (not connected)			
E/I control input: pull-up resistance	6.8 kΩ			
Response time; switching frequency[5])	max. 50 µs; max. 10,000/s			
Minimum switching frequency (required)	0.01/s			
Enclosure rating	IP 67			
Ambient operating temperature	0 to +50°C			
Storage temperature[6])	−25 to +75°C			
Connecting cable	2 m, 5 x 0.34 mm², shielded, PVC, O.D. 6 mm			
Weight	approx. 540 g			

1) Limit values; reverse-polarity protected
2) Must be within V_S tolerances
3) At room temperature = +25°C
4) Short circuit proof
5) With light/dark time ratio of 1:1; no time delay
6) Do not distort cable below 0°C

Selection Table

Part No.	Model	Switching output	Light spot orientation	Sender red	Sender green	Objective lens No. 211	Cable plug
1007861	NTA 6-N111	NPN	vertical	●	–	●	●
1006369	NTA 6-N311	NPN		–	●	●	●
1007862	NTA 6-N112	NPN		●	–	●	–
1007863	NTA 6-N312	NPN		–	●	●	–
1007864	NTA 6-P111	PNP		●	–	●	●
1007865	NTA 6-P311	PNP		–	●	●	●
1007866	NTA 6-P112	PNP		●	–	●	–
1007867	NTA 6-P312	PNP		–	●	●	–
1007869	NTA 6-N212	NPN	horizontal	●	–	●	–
1007870	NTA 6-N412	NPN		–	●	●	–
1007871	NTA 6-P212	PNP		●	–	●	–
1007872	NTA 6-P412	PNP		–	●	●	–

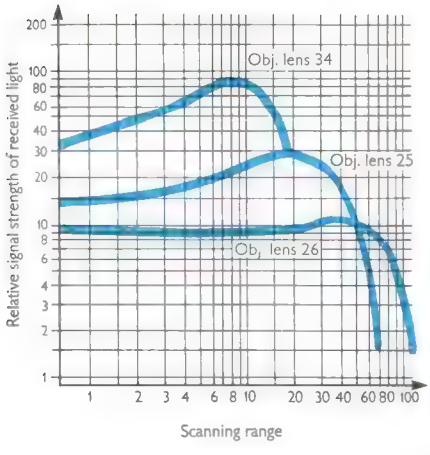


Scanning Distance

9 and 18 mm

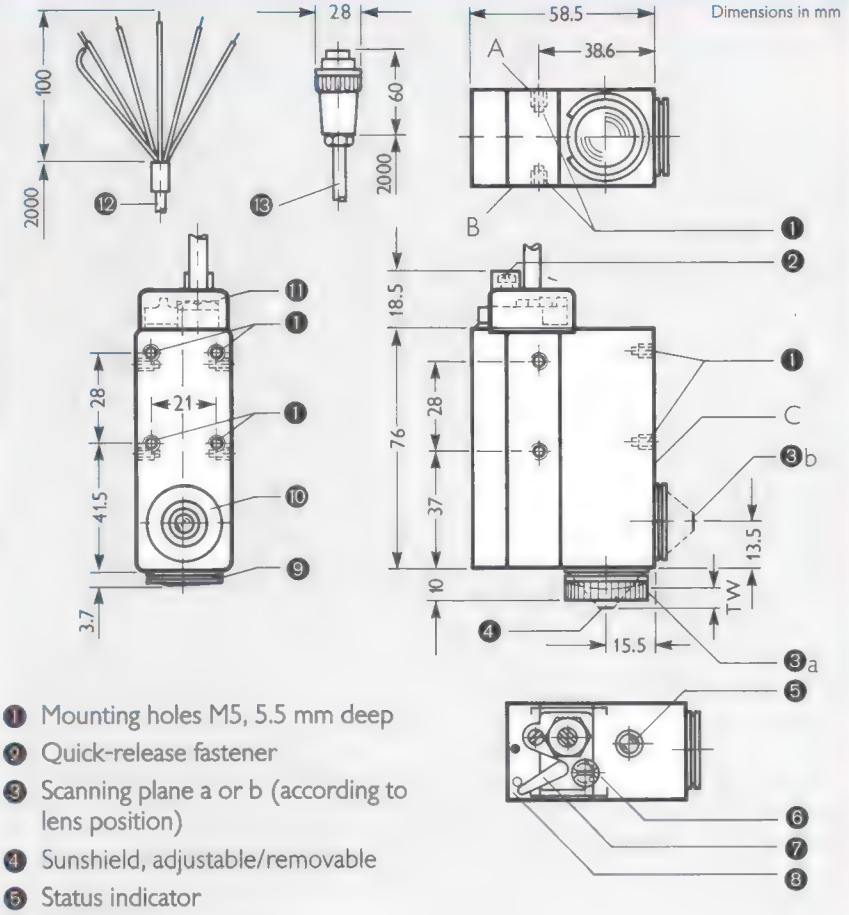
Features

- Detects very slight contrasts
- White light source, filterable
- Changeable lens position
- Switch-selectable light- or dark-switching
- Supply voltage reverse-polarity protected
- Status indicator
- Adjustable switching threshold
- Switching frequency up to 10,000/s
- Interchangeable objective lenses
- Switching output short circuit protected
- No false triggering on power-up
- Die-cast metal housing



NT 8

Dimensions in mm

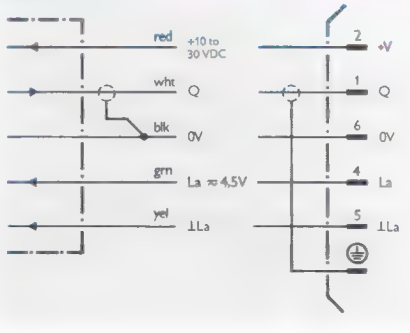


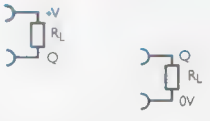
1. Mounting holes M5, 5.5 mm deep
2. Quick-release fastener
3. Scanning plane a or b (according to lens position)
4. Sunshield, adjustable/removable
5. Status indicator
6. Sensitivity control
7. Light / dark selector
8. Housing cover (remove when replacing lamp)
9. Objective lens (shown without sunshield) } interchangeable
10. Desiccant cartridge with inspection window } interchangeable
11. Cover
12. Connecting cable with crimped leads
13. Connecting cable with plug

A B C Mounting surfaces

Connection Diagram

NT 8





red	wht	blk	grn	yel
red	white	black	green	yellow

NT 8			
Part No.	see Selection Table		
Scanning distance	scanning distance	scanning dist. tolerance	light spot dimensions
With lens No. 24 (Part No. 1001324)	9 mm	± 2 mm	1.5 x 3.5 mm²
With lens No. 25 (Part No. 1001325)	18 mm	± 2 mm	2 x 5 mm²
With lens No. 26 (Part No. 1001326)	50 mm		2.5 x 6 mm²
With lens No. 27 (Part No. 1001327)	120 mm		4 x 10 mm²
Supply voltage V_S	10 to 30 VDC[1])		
Current consumption (no load)	≦50 mA		
Ripple[2])	≦2 V_{pp}		
Lamp supply voltage[3])	4.5 VAC/DC ± 10%		
Lamp current consumption	approx. 840 mA		
Light source	incandescent lamp, average service life at rated voltage: 10,000 h		
Type of light	white, visible		
Light spot orientation	lengthwise or transverse to short side of device		
Light receiver			
Wavelength	450 to 750 nm (visible light)		
With OG 530 color filter	530 to 750 nm (Part No. 1001598)		
With OG 570 color filter	570 to 750 nm (Part No. 1001599)		
With RG 610 color filter	610 to 750 nm (Part No. 1001600)		
Switching output	light- or dark-switching, switch-selectable		
Type	PNP	NPN	
Output voltage HIGH	V_S – ≦2 V	V_S	
Output voltage LOW	0 V	≦2 V	
Output current max.[4])	200 mA		
Response time; switching frequency[5])	max. 50 µs; max. 10,000/s		
Enclosure rating	IP 67		
Ambient operating temperature	0 to +55 °C		
Storage temperature[6])	–25 to +85 °C		
Connecting cable	2 m, 2x0.5 mm², 2 x 0.14 mm², 1 x 0.14 mm², shielded, PVC, O.D. 6 mm		
Weight (incl. connecting cable)	approx. 300 g		

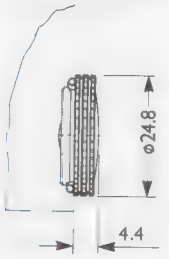
1) Limit values; reverse-polarity protected
2) Must be within V_S tolerances
3) Voltage drop on cable should be taken into account
4) Short-circuit proof
5) With light/dark time ratio of 1:1; no time delay
6) Do not distort cable below 0°C

Selection Table

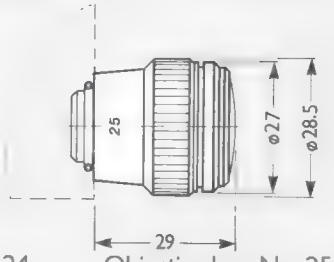
Part No.	Model	Light spot orientation	Switching output	Objective lens	Option	Cable plug
1005981	NT 8-01412	vertical	NPN	No. 24	–	●
1005985	NT 8-02412		NPN	No. 24	–	–
1005983	NT 8-01512		NPN	No. 25	–	●
1005987	NT 8-02512		NPN	No. 25	–	–
1006007	NT 8-16412		NPN	No. 24	increased sensitivity	–
1006011	NT 8-17412		NPN	No. 24	increased sensitivity	●
1006039	NT 8-21412		PNP	No. 24	–	●
1006043	NT 8-22412		PNP	No. 24	–	–

174 | NT 6 Contrast control scanner using a blue registration mark to control the correct location of printing

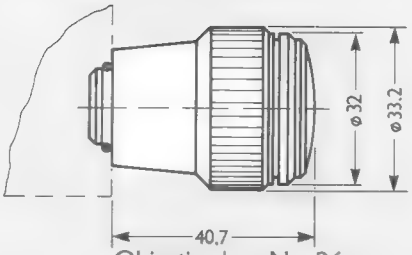
Objective lenses for NT 8



Objective lens No. 24
SD 9 mm
Part No. 1001324

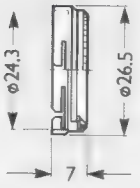


Objective lens No. 25
SD 18 mm
Part No. 1001325



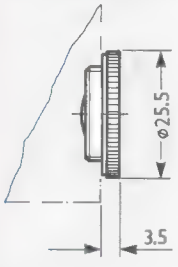
Objective lens No. 26
SD 50 mm
Part No. 1001326

Objective lens No. 27, SD 120 mm
Part No. 1001327

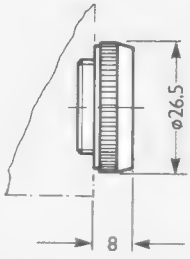


Filter for NT 8 and objective lens No. 24

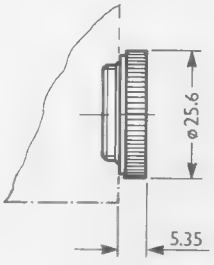
for NT 6, NTA 6



Objective lens No. 211
SD 9 mm
Part No. 1004936



Objective lens No. 213
SD 18 mm
Part No. 2009266



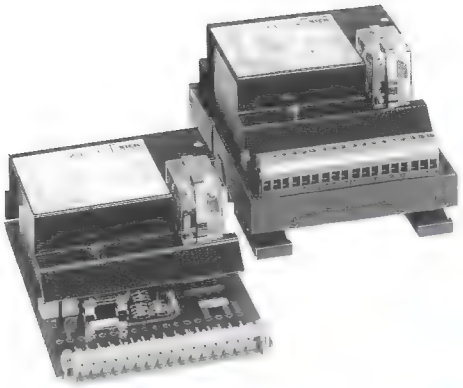
Objective lens No. 208
SD 12.5 mm
Part No. 2011778

Objective lens No. 214
SD 50 mm
Part No. 1004968

SD = scanning distance

Connecting cable for NT 8	**Part No.**
Connecting cable, specify length in meters, 5-core., 2×0.5 mm², 2×0.14 mm², 1×0.14 mm², shielded, PVC	6000616
Extension cable, complete with plug and receptacle, 2 m	2002264
4 m	2002909
6 m	2006810
for NT 6, NTL 6, NTA 6	**Part No.**
Connecting cable, specify length in meters, 5 x 0.34 mm² shielded, PVC	6005897
Plug connector for contrast scanners	**Part No.**
Male plug (cable mount) T 3104/1	6004193
Female plug (cable mount) T 3105/1	6004194
Male receptacle (panel mount) T 3106	6004195
Female receptacle (panel mount) T 3107	6004196
Straight cable receptacle, 4-pin, for NT 6 with plug (NT 6-03018, NT 6-04018), see page 151	6007302
Right-angle cable receptacle, 4-pin, for NT 6 with plug (NT 6-03018, NT 6-04018), see page 151	6007303

Light source for NT 8	**Light spot orientation**	**Part No.**
Incandescent lamp	horizontal filament	1001019
	vertical filament	1001273



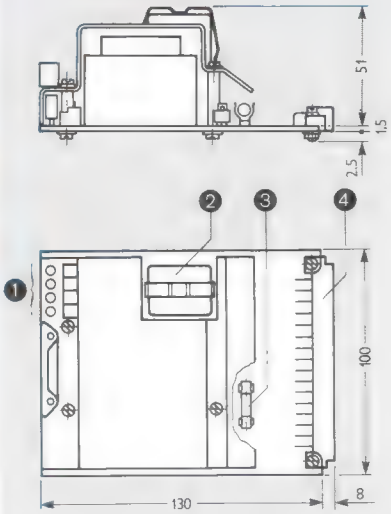
For NT 6, NTA 6, NTL 6 and NT 8 Contrast Scanners

Features

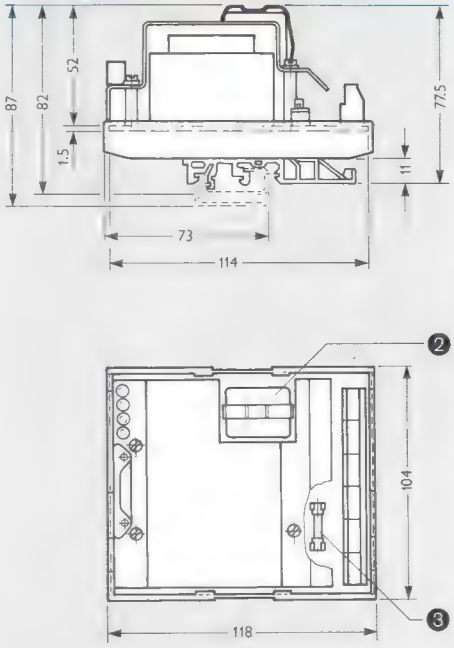
- Eurocard (shortened) 100 x 130 mm² with 32-pin strip (DIN), a and c layout
- Plug-in card holder for wall mount capability (front connection)
- Choice of line voltages (factory setting: 220 VAC)
- Lamp voltage 4.5 V, 1 A
- Relay output
- Status indication by four LEDs
- Choice of six different time functions:
  - ON-delay
  - OFF-delay
  - ON- and OFF-delay
  - positive-edge triggered ONE SHOT
  - negative-edge triggered ONE SHOT
  - no time delay
- Continuously adjustable time

MVE 1-150/1-250

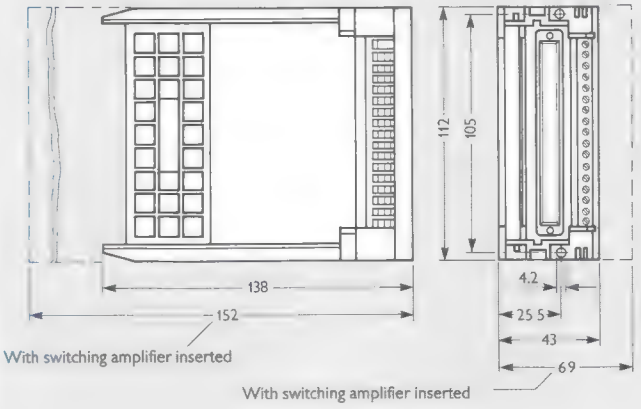
MVE 1-150



MVE 1-250



1. Indicator lights
2. Relay (plug-in)
3. Fuse (NT 8 sender lamp)
4. Multiple plug connector, DIN 41612, D format



Input Functions
Reset Input RS
Memory reset with HIGH signal at RS. RS input has priority over all other inputs.

External Trigger Input $\overline{FS}$
Memory set with LOW signal at $\overline{FS}$. $\overline{FS}$ only effective for machine- controlled reset.

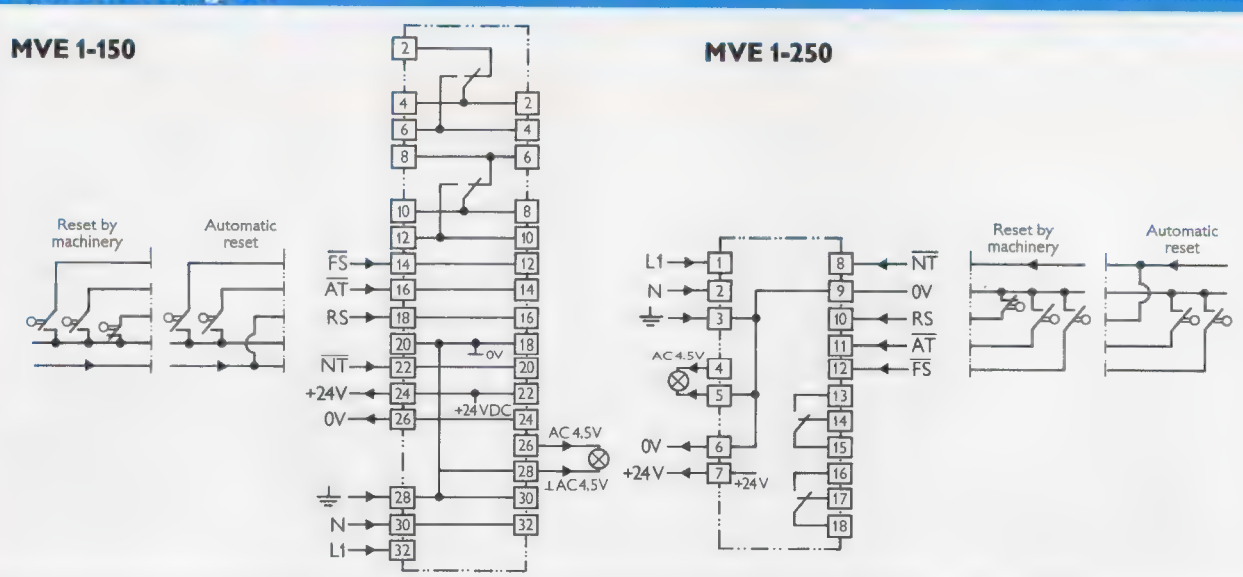
Scanner Input $\overline{NT}$
Memory set with LOW signal at $\overline{NT}$. When not resetting with RS command (machine contact), $\overline{NT}$ can be connected to RS.

Blanking Input $\overline{AT}$
(Enable/Inhibit)
Setting commands at $\overline{NT}$ and $\overline{FS}$ ignored with LOW signal at $\overline{AT}$.

MVE 1-150 / MVE 1-250
Switching Amplifier

MVE 1	-150	-250
Part No.	1008964	1010494
Card holder with receptacle, Part No.	6000353	
Supply voltage	100, 110, 120, 200, 220, 240 VAC (+10%, –15%)	
Power consumption	approx. 10 VA	
Inputs	$\overline{NT}$, $\overline{FS}$, $\overline{AT}$, RS	
Input voltage HIGH	≧10 to ≦24 V	
Input voltage LOW	≦2 V	
Input current LOW	1 mA	
Outputs		
Power supply for NT electronics	24 VDC (+5%, –15%)	
Output current max.	80 mA	
Output voltage for NT 8 sender lamp	4.5 VAC	
Output current max.	1 A	
Relay output	DPDT	
Switching voltage max.	250 VAC	
Switching current max.	10 A	
Switching power max.	650 VA (AC), 240 W (24 VDC), 48 W (48 VDC)	
Time delay		
ON-delay	0.1 to 2.5 s	
OFF-delay	0.1 to 2.5 s	
Positive-edge triggered	0.1 to 2.5 s	
Negative-edge triggered	0.1 to 2.5 s	
Enclosure rating	IP 00	
Ambient operating temperature	–20 to +65 °C	
Storage temperature	–20 to +75 °C	
Weight	approx. 630 g	
Substitute relay	Part No. 6000978	

Connection Diagram

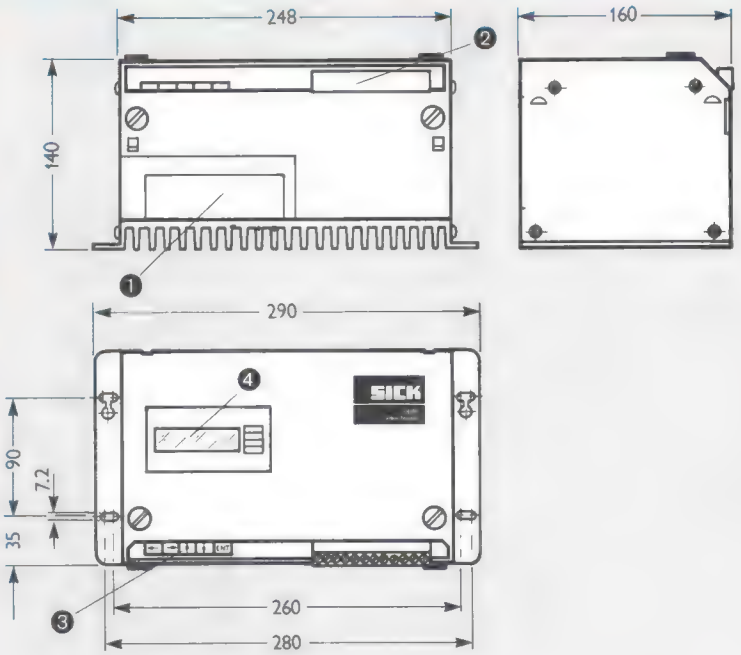


For NT6, NTA6, NTL6, Contrast Scanner

Features

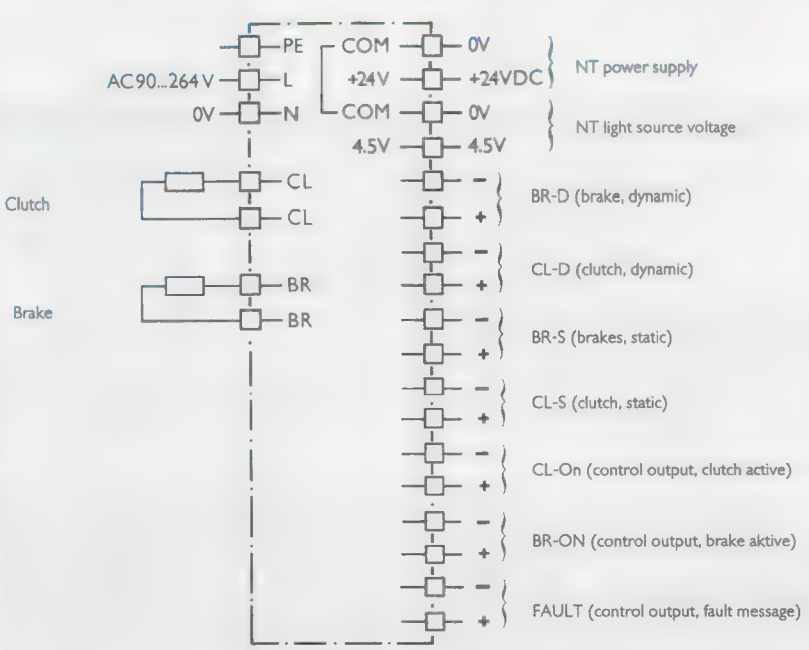
- High-speed switching of electric brakes and clutches
- Freely programmable parameters:
  — solenoid current
  — time delay for brake
  — quick-energizing time
  — quick-energizing current
- Universal supply voltage
- Universal coil voltage
- Current-regulated overexcitation
- Four floating optocoupler inputs
- Three floating optocoupler outputs
- Floating current supply for the contrast scanner

MV 10



❶ Cable connection
❷ Control inputs
❸ Programming keys
❹ Alphanumeric display

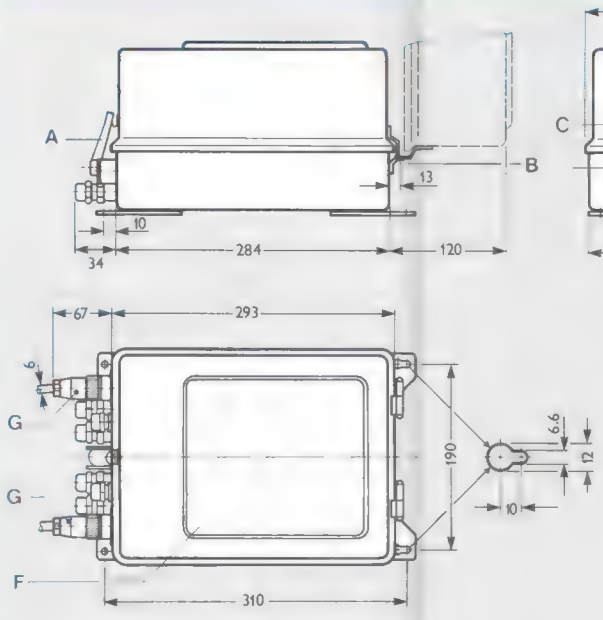
Connection Diagram



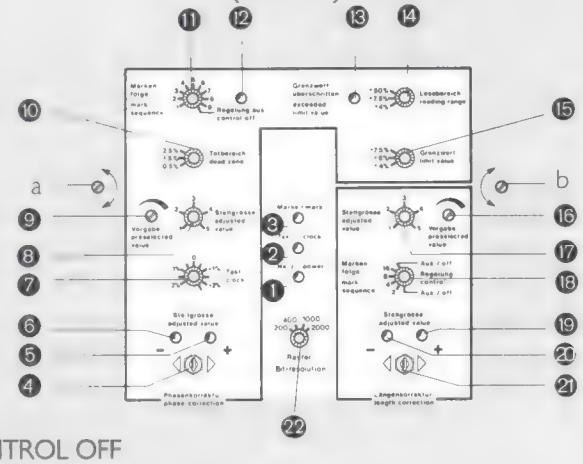
MV 10
Switching Amplifier

MV 10	
Part No.	6 009 427
Supply voltage	90 to 264 VAC (absolute limit values)
Power consumption	288 VA (maximum)
Inputs	floating optocoupler inputs 10 to 30 VDC
Brake, static	BR-S
Brake, dynamic	BR-D
Clutch, static	CL-S
Clutch, dynamic	CL-D
Outputs	
Power supply: NT	24 VDC/100 mA short-circuit proof
Power supply: light source	4.5 VDC/800 mA short-circuit proof
Control outputs	floating optocoupler outputs 10 to 30 VDC/100 mA
Brake, aktive	BR-ON
Clutch, active	CL-ON
Fault message	FAULT (with undervoltage, short-circuit, earth contact)
Power circuit outputs	Exclusive OR-operation with overexcitation
Solenoid voltage	3 to 48 V
Solenoid current	0.9 to 6 A adjustable
Overexcitation	current-regulated, value and duration of current separately adjustable
Time delay	
Brake	on delay 0 to 250 ms adjustable
Clutch	on delay 0 to 250 ms adjustable
Ambient operating temperature	−20 to +50 °C
Storage temperature	−20 to +70 °C
Enclosure rating	IP 20

SR 2



- **A** Quick-release fastener
- **B** Hinge for opening and removing top part of housing
- **C** PG 9 cable gland (3x) for cables, O.D. 4 to 8 mm
- **D** Receptacle (for NT 8) T 3105/1
- **E** PG 11 cable gland (4x) for cables, O.D. 5 to 10 mm
- **F** Inspection window
- **G** Male plug (cable mount) (for NT 8) T 3104/1

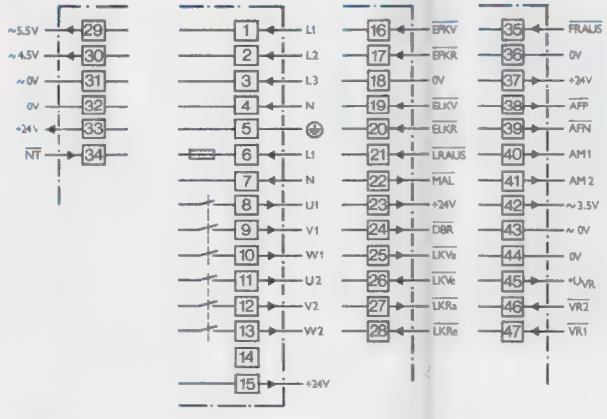


1. Indicator light POWER
2. Indicator light CLOCK
3. Indicator light MARK
4. Toggle switch ADJUSTED VALUE ± for manual phase correction
5. Indicator light ADJUSTED VALUE +
6. Indicator light ADJUSTED VALUE –
7. Selector switch CLOCK
8. Control ADJUSTED VALUE
9. Control PRESELECTED VALUE
10. Selector swich DEAD ZONE
11. Selector switch MARK SEQUENCE for phase correction
12. Indicator light CONTROL OFF
13. Indicator light EXCEEDED LIMIT VALUE
14. Selector switch READING RANGE
15. Selector switch LIMIT VALUE
16. Control PRESELECTED VALUE (length correction)
17. Control ADJUSTED VALUE (length correction)
18. Selector switch MARK SEQUENCE for length correction
19. Indicator light ADJUSTED VALUE + for length correction
20. Indicator light ADJUSTED VALUE – for length correction
21. Toggle switch ADJUSTED VALUE ± for length correction
22. Bit setting (adaptation to timing bars of the shaft timing encoder)

a,b Quick-release fasteners

Connection Diagram

SR 2



SR 2
Two-way Registration Control

SR 2	
Part No.	see Selection Table
Supply voltage	220 VAC (+10%, –15%)
Power consumption	approx. 55 VA
Inputs	NT, proximity switches
Input voltage HIGH	+11 to +50 V
Input voltage LOW	≦+4 V
Input current	15 mA
Signal duration (mark and clock), min.	1.5 ms
Signal duration (other input signals), min.	30 ms
Signal duration (shaft timing encoder), min.	0.025 ms (shaft timing encoder R 200/400/600/1000/2000)
Outputs	
Power supply for NT electronics	24 VDC
Output current max.	100 mA
Output voltage for NT 8 sender lamp	4.5 VAC, 5.5 VAC
Output current max.	2.5 A
Relay output	
Switching voltage max.	380 VAC
Switching current	4 A
Analog output for pointer-type instrument	≦±20 mA
Control	
Clock (fine adjustment in 0.5% steps)	–2 to +2.5%
Mark sequence	1 to 9 (phase-correction control range), 2 to 6 (length-correction control range)
Reading range	±4%, ±7.5%, ±50%[1]) (phase-correction control range)
Dead zone	0.5%, 1.5%, 2.5% (control range)
Limit value	±4%, ±6%, ±7.5% (control range)
Adjusted value	1:5 (t/setting max. 0.5 s), phase- and length-correction control range
Preselected value	±30 ms (phase- and length-correction control range)
Number of register-pattern lengths / min.	
With timing disk	min. 30 to max. 8000
With shaft timing encoder	>0 to max. ≦6000
Enclosure rating	IP 64
Ambient operating temperature	0 to +55 °C
Storage temperature	–40 to +85 °C
Weight	9.5 kg

1) This value does not change with a different resolution

Selection Table

Part No.	Model	Design
1004486	SR 2-1433	phase correction with phase supplement board and housing
1004487	SR 2-1443	phase correction with phase supplement board without housing
1004612	SR 2-1453	phase correction with length correction and housing
1004613	SR 2-1463	phase correction with length correction without housing

Two-way registration control controls shifts in phase and length when cutting a moving web, which are caused by slip between cutting station and printed pattern lengths.


LUT
LUT

Luminescence Scanners

Luminescence Scanners

Modern production and processing techniques call for the optical detection of markings. Registration control scanners are able to detect printed marks on packaging material, thereby ensuring correct cutting and folding. In logistics, receptacles are marked according to storage destinations; in quality control, defects are marked; but it may also be necessary to monitor adhesive application to a material, for example.

Provided the marking is clearly distinguishable from the background, reliable information can be obtained using conventional photoelectric sensors.

In practice, however, this is not always the case, either because markings on a high-contrast texture, such as wood, cannot be read, or because there is no contrast at all, e.g. adhesive applied to paper, grease to metal, or oil on water. It may even be the basic intention that the marking should not be detected by the human eye.

In these and many similar instances, luminescence scanners can help to solve the problem. As the name suggests, they make use of the physical effect of photoluminescence: light of a short wavelength is converted to light of a longer wavelength.

The luminescence scanner emits ultraviolet radiation with a wavelength of approx. 365 nm. This activates a fluorescent substance which emits in the (predominantly) visually detectable range, i.e. in a spectral range between blue (450 nm) and dark red (780 nm).

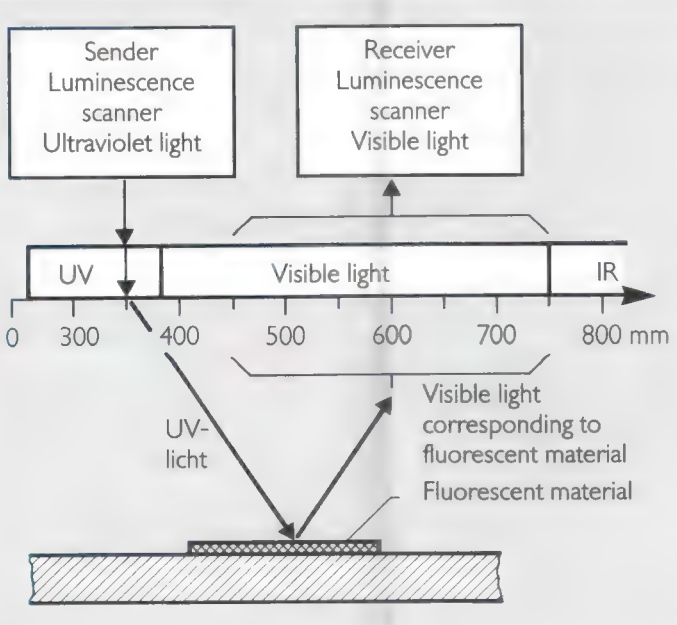
This luminescent radiation is picked up by the luminescence scanner's light receiver. The optical signal (electronically prepared) is available for use as a switching signal. In parallel with the switching output, an analog signal offers the possibility of measuring the efficiency of the conversion.

The luminescence scanner works with modulated light, the receiver responding only to light of the same modulation frequency.

A variety of fluorescent marking agents are commercially available, some of which are ready for use. They include:

- Daylight paints
- Chalks and crayons
- Optical brighteners (for paper, textiles, soaps and plastics)
- Highlighter pens
- Fluorescent inks
- Varnishes / lacquers
- Oils / greases

Fluorescent pigments suitable for marking adhesives, for example, are also available.



Principle of luminescence scanning

LUT 1-4, LUT 1-5
Luminescence Scanners

LUT 1-4

8 to 300 mm

LUT 1-5

8 to 125 mm

Luminescence scanners in die-cast housing. Interchangeable objective-lenses for different scanning distances.

Insensitive to surface reflections. Spectral sensitivity restricted by optical filter attachments.

Long-life UV light source.

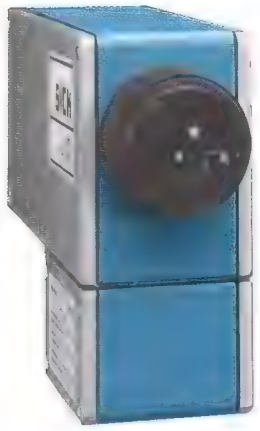
Status indicator (in addition to readiness and digital indication of degree of luminescence on LUT 1-4).

Supply voltage range 18 to 30 V. Enclosure rating IP 63 (LUT 1-4) and IP 64 (LUT 1-5).

Also available as photoelectric fiber-optic switches.

Rear view of LUT 1-4 luminescence scanner, showing sensitivity control, digital indication of degree of luminescence, status indicator and readiness indicator.

Inside the LUT 1-5

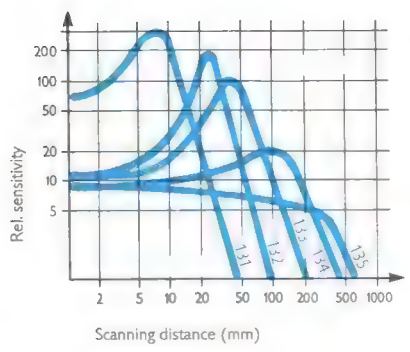


Scanning Distance

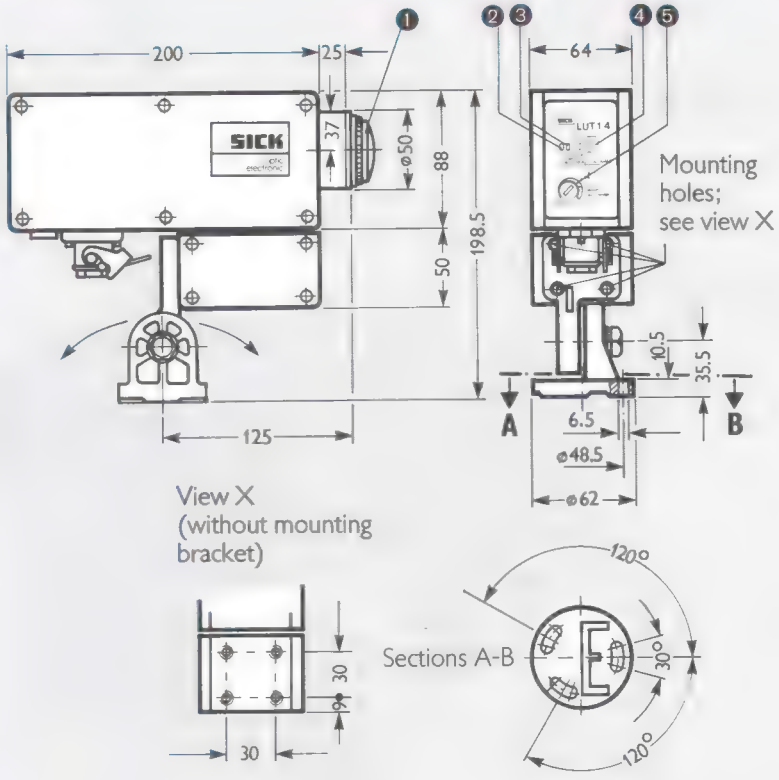
8 to 300 mm

Features

- UV light source with high-pressure mercury vapor lamp
- Digital intensity reading of received light
- Status indicator
- Choice of scanning ranges through interchangeable objective lenses
- Insensitive to surface reflections
- Spectral sensitivity restricted by optical filter attachments
- Adjustable sensitivity
- Short response time
- Analog monitoring output
- Readiness indicator
- Facility for connection of fiber-optic cable
- Supply connections reverse-polarity protected
- Metal housing



LUT 1–4



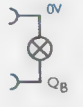
1. Interchangeable objective lens
2. Readiness indicator
3. Status indicator
4. Digital intensity indicator
5. Sensitivity control

Connection Diagram

LUT 1–4

Q_L PNP

Q_B Ready



Q_{LU} Analog

red	blu	grn	brn	wht	blk	yel
red	blue	green	brown	white	black	yellow

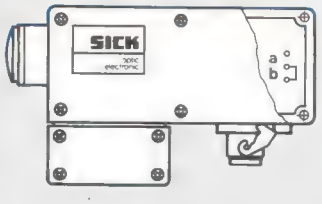
LUT 1-4
Luminescence Scanner

LUT 1-4	00	10	20	30	40	50
Part No.	1007 626	1005 935	1005 936	1005 937	1005 938	1005 939
Objective lens	f. fib.-opt. cable	No. 131	No. 132	No. 133	No. 134	No. 135
Objective lens, Part No.	–	1001 681	1001 682	1001 683	1001 684	1001 685
Scanning distance	w/o/w/lens144					
Focal plane	8/15 mm	8 mm	20 mm	50 mm	125 mm	300 mm
Scanning range (see diagram)		5 to 12 mm	12 to 32 mm	32 to 80 mm	80 to 200 mm	200 to 500 mm
Light spot diameter	10/6 mm[1])	3 mm	4 mm	8 mm	15 mm	40 mm
Light spot with diaphr. (fiber-optic cable)[2])	3 mm × 6 mm[2])					
Supply voltage V_S[3])	18 to 30 VDC					
Ripple max.[4])	2 V_{pp}					
Current consumption (no load, at 24 VDC)	700 mA					
Light source	high-pressure mercury vapor lamp					
Wavelength	365 nm					
Modulation frequency	33 kHz					
Average service life	4000 h					
Switch-on time delay	approx. 2 min. (restart lock)					
Switching outputs Q_L and Q_B	PNP, light- or dark-switching; signal output Q_L; operational readiness Q_B					
Output voltage	HIGH: V_S – <2 V, LOW: 0 V					
Output current[5])	200 mA					
Pull-down resistance	10 kΩ					
Switching frequency, scanning ratio 1:1	max. 5000/s					
At maximum sensitivity	2.5 ms					
Response time	0.1 ms					
At maximum sensitivity	2.5 ms					
Analog output Q_{LU} (R_i = 1 kΩ)	0 to 1.5 VDC					
Ambient operating temperature	0 to +45 °C					
Storage temperature[6])	–25 to +85 °C					
Enclosure rating	IP 63					
Weight (incl. mounting bracket)	2.5 kg					

1) Without diaphragm
2) Diaphragm included
3) Limit values; reverse-polarity protected
4) Must be within V_S tolerances
5) Short circuit proof
6) Do not distort cable below 0 °C

Truth Table for LUT 1-4

Internal jumper	o a o b o			o a o b o		
	State of delivery			State of delivery		
Mode	light-switching			dark-switching		
Sender lamp	off	started		off	started	
Luminescence	-	yes	no	-	yes	no
Output Q_B (PNP)	LOW	HIGH		LOW	HIGH	
Ready indicator (red)	on	off/blinking*)		-	off/blinking*)	
Output Q_L (PNP)	LOW	HIGH	LOW	LOW	LOW	HIGH
Status indicator (green)	off	on	off	off	on	off



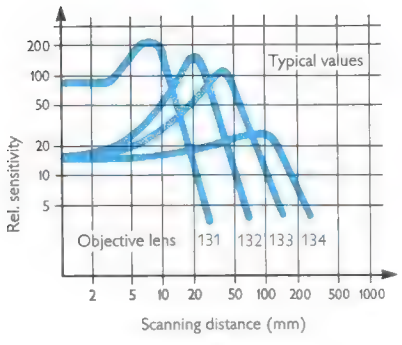
*) blinking:
lamp power still sufficient for operation

Scanning Distance

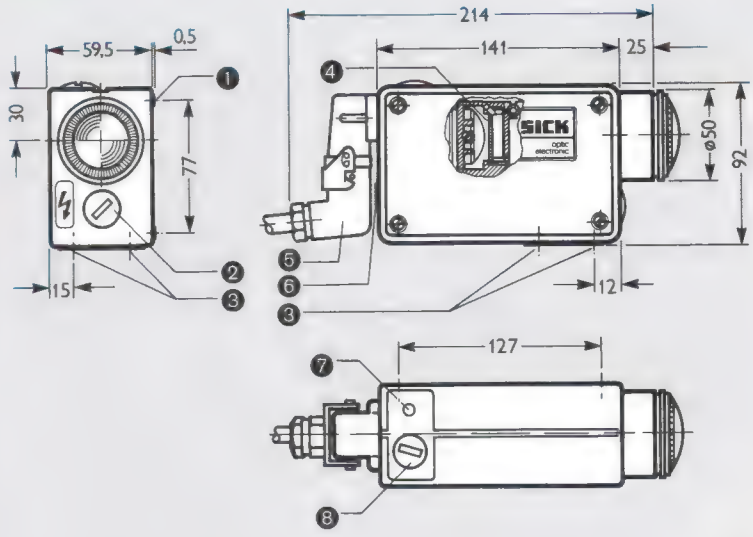
8 to 125 mm

Features

- Long-life UV-A fluorescent tube by virtue of controlled lamp heating
- Status indicator
- Choice of scanning range through interchangeable objective lenses
- Insensitive to surface reflections
- Spectral sensitivity restricted by optical filter attachments
- Adjustable OFF-delay
- Adjustable sensitivity
- Switching outputs PNP and NPN, short circuit protected
- Remote selection of light- or dark-switching mode
- Analog monitoring output (power source)
- Supply connections reverse-polarity protected
- Metal housing



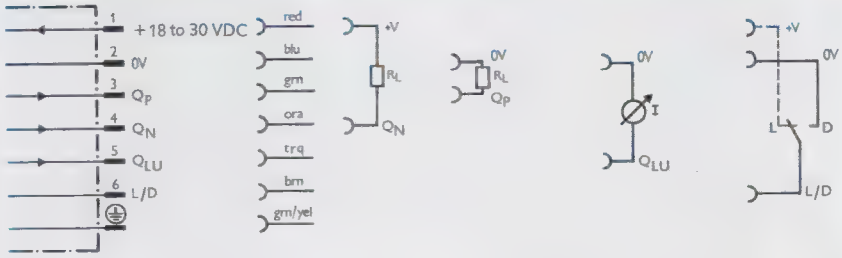
LUT 1-5



1. 4 threaded mounting holes M6, 13 mm deep
2. PG 13.5 (UV lamp underneath)
3. 4 threaded mounting holes M5, 7.5 mm deep
4. Filter attachment Optical filters
5. Cable receptacle (accessories), Part No. 2007 901
6. Cap srew M18 x 1 (interchangeable with desiccant cartridge)
7. Status indicator (LED, red)
8. PG 13.5 (sensitivity control and timedelaycontrol underneath)

Connection Diagram

LUT 1-5



blu	red	grn	ora	trq	brn	yel
blue	red	green	orange	turquoise	brown	yellow

LUT 1-5
Luminescence Scanner

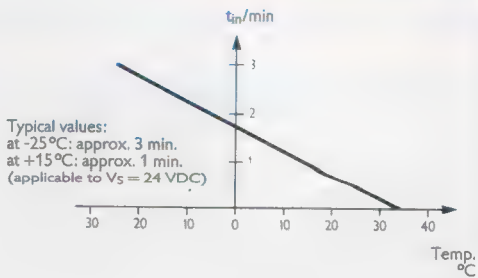
LUT 1–5	00	10	20	30	40
Part No.	1007 597	1005 931	1005 932	1005 933	1005 934
Objective lens	f. fiber-opt. cable	No. 131	No. 132	No. 133	No. 134
Objective lens, Part No.	–	1001 681	1001 682	1001 683	1001 684
Scanning distance	w/o / w/ lens 144				
Focal plane	8 / 15 mm	8 mm	20 mm	50 mm	125 mm
Scanning range (see diagram)		1.5 to 10 mm	14 to 28 mm	22 to 56 mm	30 to 140 mm
Light spot diameter	10 / 6 mm[1]	5 mm	8 mm	15 mm	35 mm
Light spot with diaphr. (fiber-optic cable)[2]	3 mm × 6 mm[2]				
Supply voltage V_S[3]	18 to 30 VDC				
Ripple max.[4]	2 V_{pp}				
Current consumption (no load, at 24 VDC)	< 800 mA				
Light source	UV-A fluorescent tube				
Wavelength	365 nm				
Modulation frequency	2.5 kHz				
Average service life	8000 h				
Switch-on time delay	approx. 1 min. at ambient temperature = 15 °C				
Switching outputs Q_N and Q_P	NPN / PNP, light- or dark-switching				
Output voltage PNP	HIGH: V_S – < 2 V, LOW: < 0.5 V				
Output voltage NPN	HIGH: V_S – < 1 V, LOW: < 1 V				
Output current[5]	200 mA				
Pull-up / pull-down resistance	10 Ω				
Response time; switching frequency	max. 1 ms; max. 250/s				
Time delay	adjustable from 3 ms to 100 ms				
Analog output Q_{LU} (R_L < 800 Ω)	0 to 10 mA				
Ambient operating temperature[6]	–25 to +50 °C				
Storage temperature[6]	–25 to +85 °C				
Enclosure rating	IP 64				
Weight (without mounting bracket)	1.1 kg				

1) Without diaphragm
2) Diaphragm included
3) Limit values; reverse-polarity protected
4) Must be within V_S tolerances
5) Short circuit proof
6) Do not distort below 0 °C

Truth Table for LUT 1–5

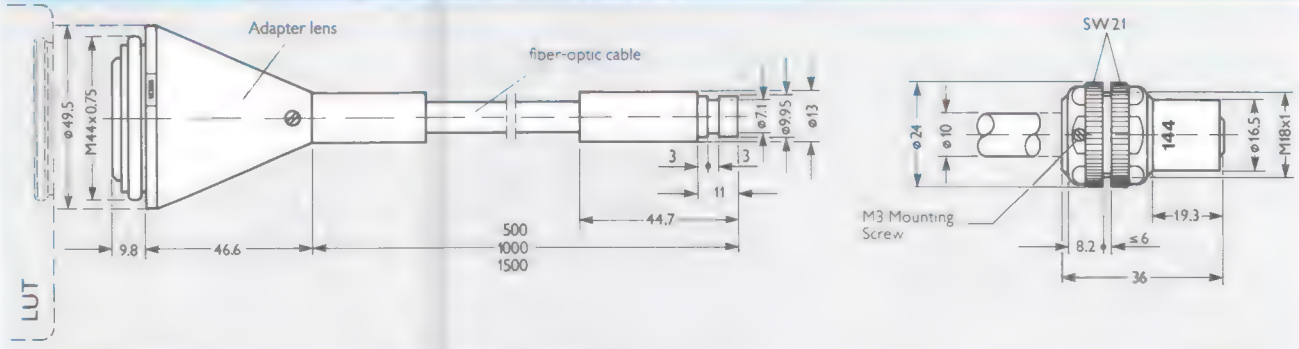
a/b	+ V or open			0 V		
Mode	light-switching			dark-switching		
Sender lamp	off	started		off	started	
Luminescence	-	yes	no	-	yes	no
Output Q_{PNP}	LOW	HIGH	LOW	HIGH	LOW	HIGH
Output Q_{NPN}	HIGH	LOW	HIGH	LOW	HIGH	LOW
Status indicator	off	on	off	off	on	off
		blinking*)		blinking*)		

*) Blinking: Lamp power still sufficient for operation



Switch-on time delay as a function of ambient temperature for LUT 1–5.

Fiber-optic cable



Minimum bending radius of fiber-optic cable R = 60 mm

Temperature range: –5 ... +35 °C
Not to be mechanically loaded outside ambient temperature range. Not to be distorted below 0 °C.

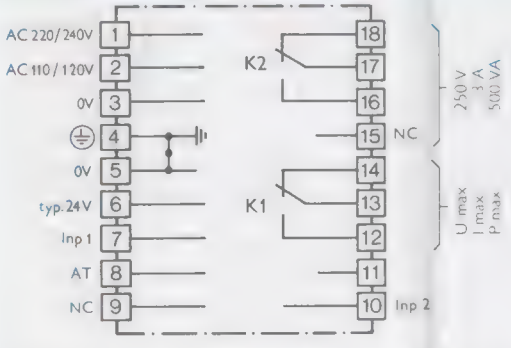
Attachment lens no. 144

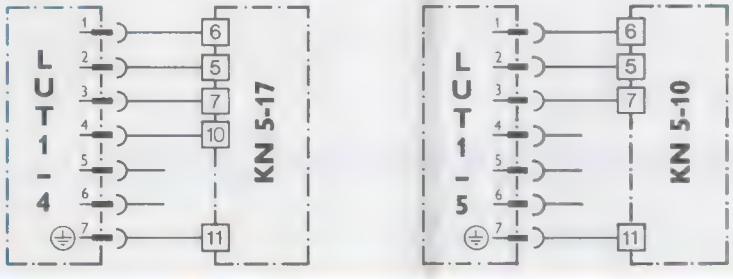
Fiber-optic cables including adapter lens (for LUT 1-5 and LUT 1-4)

LLUV 5- 500	1005 621	500 mm long
LLUV 5-1000	1005 622	1000 mm long
LLUV 5-1500	1005 623	1500 mm long

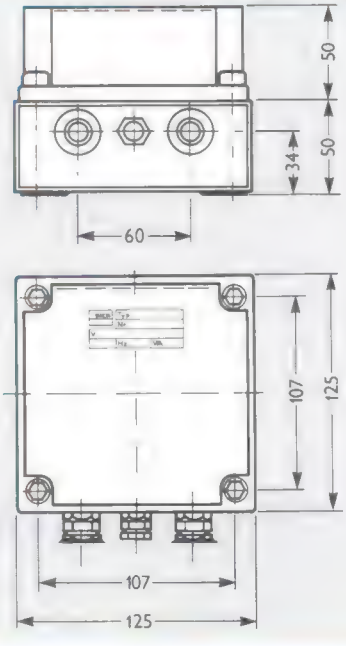
KN 5 Switching Amplifier

Connection diagram for KN 5





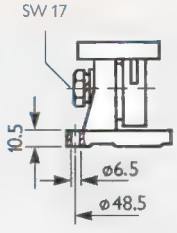
Dimensional drawing



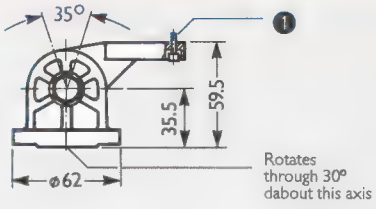
Technical Data

KN 5	-101	-103	-171	-173
Part No.	1004 699	1005 480	1004 653	1005 181
Supply voltage	110/220 V	120/240 V	110/220 V	120/240 V
for LUT	LUT 1–5		LUT 1-4	
Input 1	Relay K2		0.1 s Fall-delay time K2	
Input 2	Relayl K1		Relay K1	
Input AT	NC		HIGH: Scanning K2	
Electronics supply	typ 24 V/max. 0.8 A		typ 24 V/max. 0.8 A	

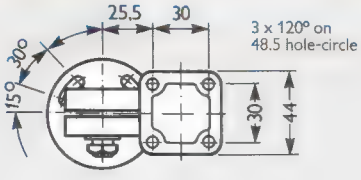
Mounting bracket for LUT 1-5



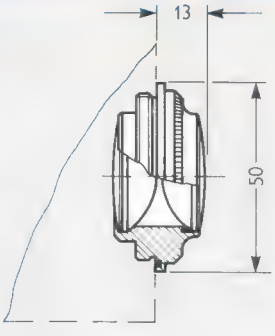
Part No. 1005 580



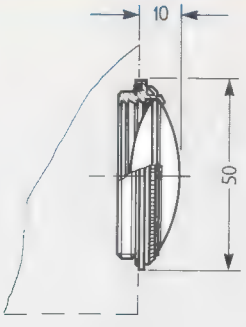
1 4 Allen screws M6 x 10
with DIN 137 spring washer



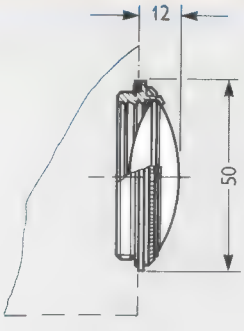
Objective lenses



Obj. lens 131 Part No. 1001 681
(Obj. lens 132 Part No. 1001 682)



Obj. lens 133 Part No. 1001 683
(Obj. lens 134 Part No. 1001 684)



Obj. lens 135 Part No. 1001 685

Further accessories

Connecting cable	LUT 1-4	LUT 1-5
with receptacle, 2 m	2006 545	2008 423
with receptacle 6 m	2006 860	2008 425
with receptacle 10 m	2007 595	2008 427
Connecting cable, specify in meters	6000 607	6006 501
Slotted mask to limit lens coverage	-	4017 694
Colour filter		
OG 570 570...750 nm	4005 810	4018 534
OG 610 610...750 nm	4012 735	4018 535
RG 630 630...750 nm	4014 153	4018 536
RG 665 665...750 nm	4014 154	-
Luminescent chalk		
Chalk, water-soluble	1004 460	
Chalk, non water-soluble	1002 959	

192 | WSU/WEU 26 photoelectric safety switch guarding the access to a palletizer in the beverage industry

Photoelectric Safety Switches

Photoelectric Safety Switches Mode of Operation

Photoelectric safety switches such as the WSU/WEU 26 are through-beam devices consisting of a separate light source (WSU) and light receiver (WEU). Between the source and the receiver, the light beam safeguards danger areas.

In order to fulfill their role, the photoelectric switches need to be self-monitoring, i.e. faults in the device itself have to be detected and issued as a "Stop" command to the control unit of the machine or equipment constituting a hazard.

Control of the machine also needs to be self-monitoring: when there is a fault on the control system, no further dangerous movement must be executed. After switch-on and a "Stop" command, it should only be possible to initiate the dangerous movement again via a control device (restart lock).

Development and production of the devices correspond to recognized standards of technology. If the user observes the prescribed conditions of use, he will be adequately protected.

When using a photoelectric safety switch, one has to bear in mind that humans must not have access to the danger area until movement has ceased. A safety distance (S) consequently has to be maintained, calculated from:

$S = v\,(t_1 + t_2) + 1000^*$

where:

S = safety distance (mm)

v = speed of approach (m/s) (recommended 1.6 m/s)

t_1 = machine stop time (ms)

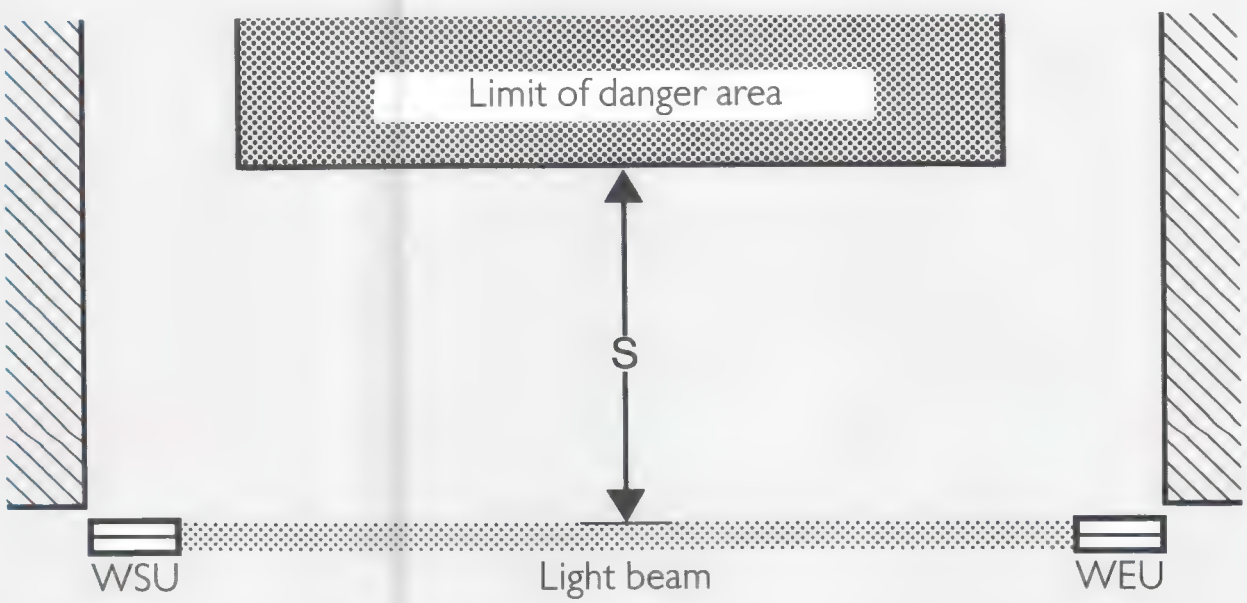
t_2 = response time of WEU (20 ms)

The safety distance must consequently be at least 1000 mm.

In the case of photoelectric switches with a relay output, at least two outputs have to be connected to the machine's control unit. A relay (electromagnetic switching device) is allocated to each of the two outputs (normally-open contacts).

After the machine is switched on, a starting test must be performed before the first dangerous movement. Such a test must be conducted at least once every 24 hours.

* See also UK standard PM 41



Applied example of a photoelectric safety switch with safety distance S from danger area.

WSU 26 / WEU 26
Photoelectric Safety Switch

WSU 26 / WEU 26

30, 60 m

Through-beam photoelectric switch in die-cast housing for protecting personnel in the access area of power-driven machinery. The device is self-monitoring, i.e. faults in the device are detected and transmitted to the machine's control system as a "Stop" command.

It is available with PG connector or plug connector.

The WSU / WEU 26 Photoelectric Safety Switch must not be used for finger- or hand-protection.

Power indicator on WSU26 (sender). Signal-strength and status indicators on WEU 26 (receiver).

There are two WSU models: one for an operating range of 0 to 30 m, and one for 30 to 60 m.

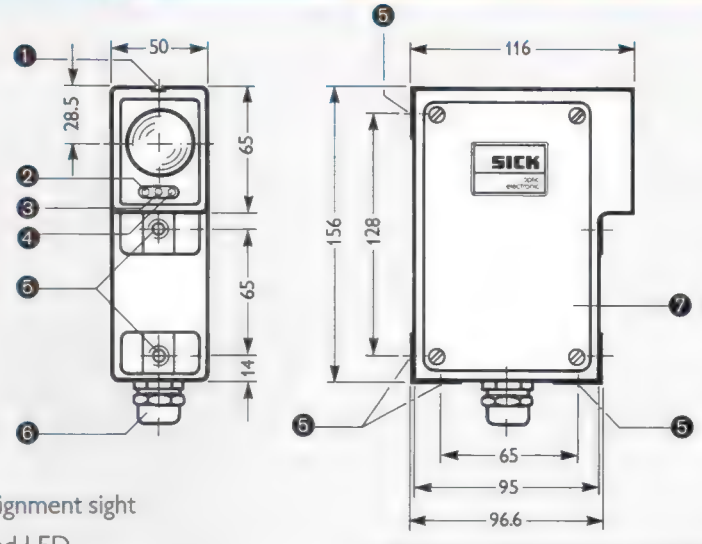
Scanning Distance

30 / 60 m

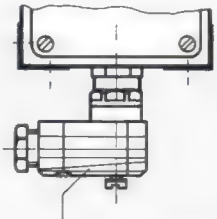
Features

- Non-contact safety device
- Test input
- LED power and signal strength indicators
- Blinking LED signal strength indicator (yellow) to show misalignment or dirt built-up on optics
- "Captive" relay contacts
- Direct voltage or alternating voltage version
- Lens heater
- Metal housing
- "Conformity Certificates":
  Federal Republic of Germany
  France
  Great Britain
  Holland
  Sweden
  Switzerland

WSU / WEU 26



Plug-connection version of device



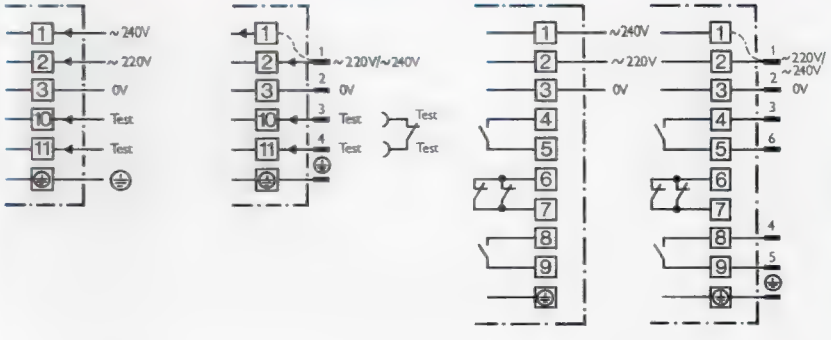
For cable receptacle (accessories), right angle, Part No. 6006 613, and straight, Part No. 6006 612, see page 139.

1. Alignment sight
2. Red LED
   (only WEU: no light received)
3. Yellow LED
   (WSU: sender on:
   WEU: sufficient light received)
4. Green LED
   (only WEU: beam uninterrupted)
5. Threaded mounting holes M 6, 8 mm deep
6. PG 13.5 cable gland
   (for cable diameter 7 to 15 mm)
7. Cover and terminal strip accessible from this side

For mounting bracket (accessories), Part No. 2007 900, see page 147.
For dust shield (accessories), Part No. 1003 556, see page 152.
For snow shield (accessories), Part No. 1003 619, see page 152.
Corner mirror PSK 1 (accessories), Part No. 1005 229.

Connection Diagram

WSU 26-110 **-111** **WEU 26-710** **-712**



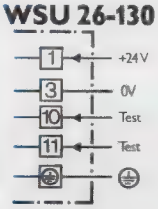
WSU 26 / WEU 26
Photoelectric Safety Switch

Model	WSU 26 Sender -110	-111	-130	-231	WEU 26 Receiver -710	-712	-730	-732
Part No.	1005 084	1005 808	1005 086	1005 700	1005 092	1005 814	1005 094	1005 701
Type of connection (T / P)[1]	T	P	T	P	T	P	T	P
Cable receptacle, Part No.	–	6006 612 6006 613	–	6006 612 6006 613	–	6006 612 6006 613	–	6006 612 6006 613
Mounting bracket, Part No.	2007 900							
Scanning range	0 to 30 m			30 to 60 m	–			
Supply voltage V_S	220/240 VAC[2]		24 VDC[3]		220/240 VAC[2]		24 VDC[3]	
Power consumption	5 VA		3 W		7 VA		5 W	
Ripple	–		≦5 V_{pp}		–		≦5 V_{pp}	
Light source	LED, infrared, modulated light				–			
Angle of dispersion / angle of reception	≦4°				≦4°			
Indicator (sender on)	LED, yellow				–			
Indicator (beam uninterrupted)	–				LED, green			
Indicator (beam interrupted)	–				LED, red			
Indicator (light received)	–				LED, yellow			
Sufficient light received	–				permanently on			
Insufficient light received	–				blinking			
Switching outputs	–				1NC,2xNO	2xNO	1NC,2xNO	2xNO
Switching voltage max. / min.	–				250 VAC / 24 VDC			
Switching current max. / min.	–				2 A / 0.02 A			
Switching power max.[4]	–				500 VA			
Response time; switching frequency max.[5]	–				≦20 ms, 10/s			
Enclosure rating	IP 67	IP 65	IP 67	IP 65	IP 67	IP 65	IP 67	IP 65
Lens heater	standard							
Ambient operating temperature	–25 to +55 °C							
Storage temperature	–40 to +75 °C							
Climate class rating (DIN 40040 / see IEC 68)	E							
Mechanical stability (DIN 40040 / see IEC 68)	Class V							
Housing	die-cast aluminium							
Housing color	RAL 10-21 cadmium yellow							
Installation orientation	any							
Weight	approx. 0.9 to 1.2 kg				approx. 1.0 to 1.2 kg			

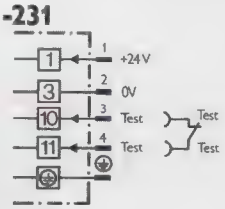
1) T = terminal chamber
P = plug connection to DIN 43 651
2) +10 to –15%
3) ±20%
4) Provide suitable arc suppression with inductive or capacitive loads
5) With light/dark time ratio of 1:1

For further versions, see Technical Description of WSU 26 / WEU 26 (available on request).
Always observe the conditions of use indicated in this description.

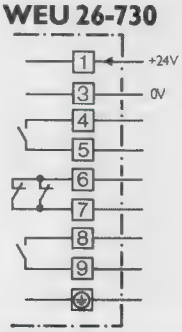
WSU 26-130



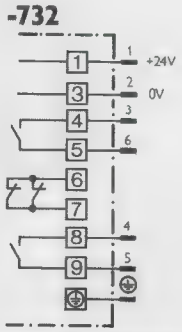
-231

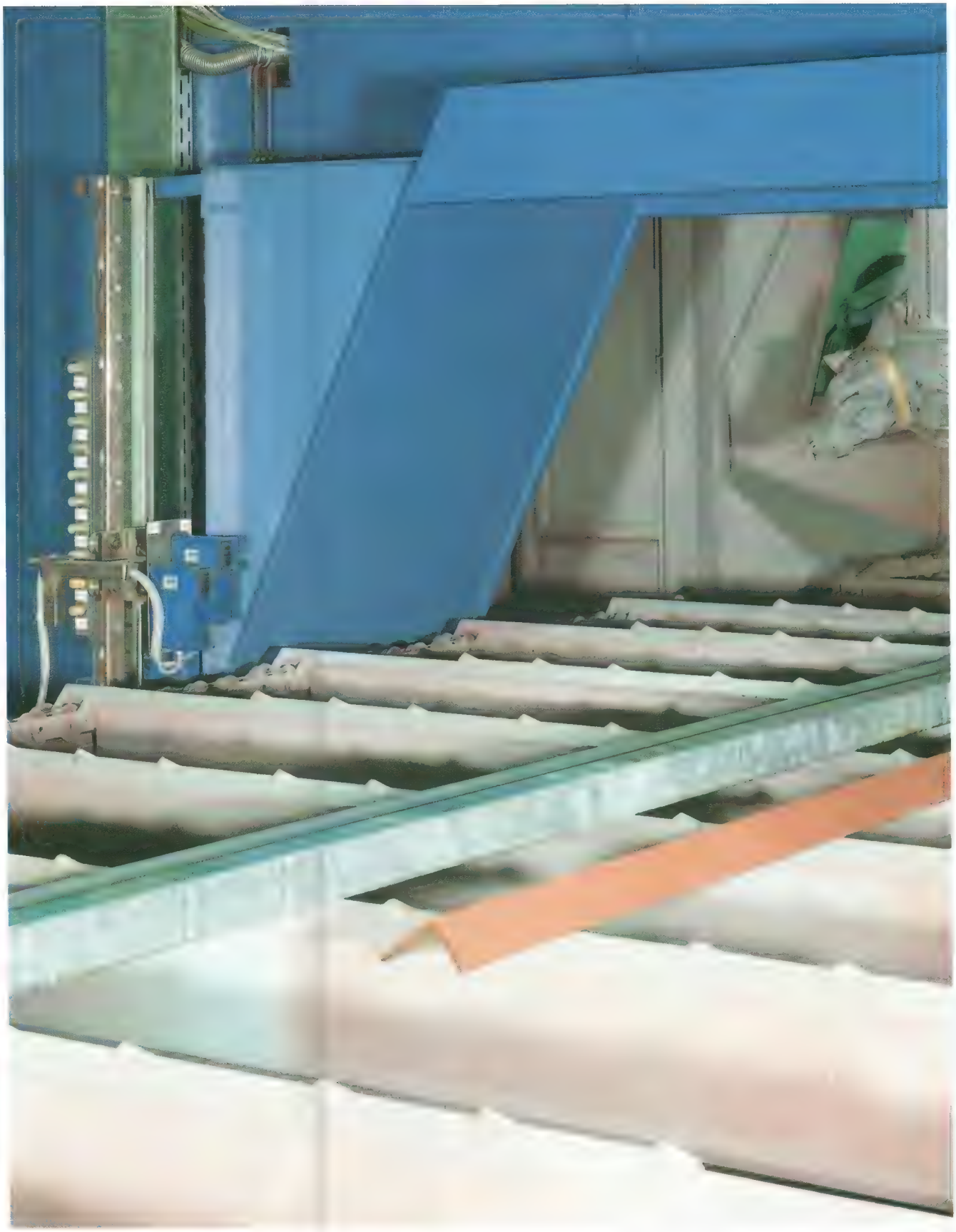


WEU 26-730



-732





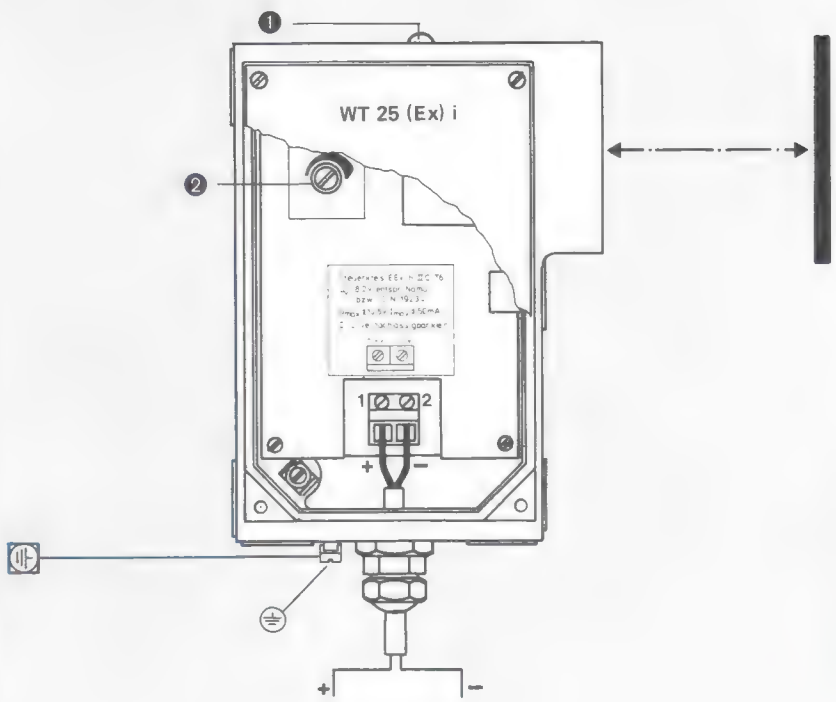
Explosion-proof Photoelectric Switches

Explosion-proof Photoelectric Switches

In areas prone to explosions, electrical equipment has to satisfy special conditions, as laid down in DIN 19234.

The WL 25 Ex i photoelectric reflex switch and WT 25 Ex i photoelectric proximity switch are designed for use in such areas. The special (electrical) feature of these devices is that their information is only relayed via a two-wire connection, conforming to NAMUR guidelines (Standardizing body for measurement and control engineering). The basic principle of these explosion-proof photoelectric switches is in fact the status-dependent control current – the current consumption varies as a function of the status. When light is received (uninterrupted beam with through-beam switch; scanned object present in the case of proximity switch), the current consumption rises above 2.2 mA; when no light is received, current consumption falls below 1 mA.

The status-dependent current consumption has to be evaluated by the KN 25 (Ex) isolation switching amplifier. Unlike the explosion-proof photoelectric switches and proximity switches, the switching amplifier is only permitted to be installed outside explosion-prone areas.



1 Status indicator
2 Sensitivity control

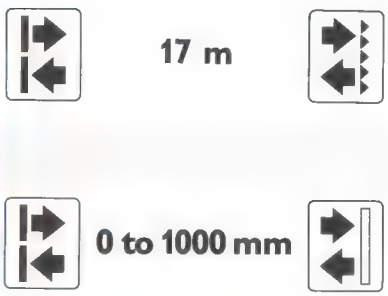
Switching mode	light-switching	
Light received	yes	no
Status indicator	on	off
Control current	≧2.2 mA	≦1 mA

Switching mode	light-switching	
Light beam	uninterrupted	interrupted
Status indicator	on	off
Control current	≧2.2 mA	≦1 mA

Explosion-proof Photoelectric Switches

WL 25 Ex i

WT 25 Ex i



Photoelectric switches in metal housing for use in areas prone to explosions. Conforming to DIN 19234.

With sensitivity control and status indicator.

Status-dependent control current.

PTB Conformity Certificate (Federal Physico-Technical Institute). The status-dependent current consumption has to be evaluated by the KN 25 (Ex) isolation switching amplifier.

Enclosure rating IP 67 (dusttight, watertight). Supply voltage range 5 to 13.5 V.

Available as photoelectric switch and proximity switch.

Inside the WL 25 Ex i

Safety proved by PTB Conformity Certificate

Scanning Distance

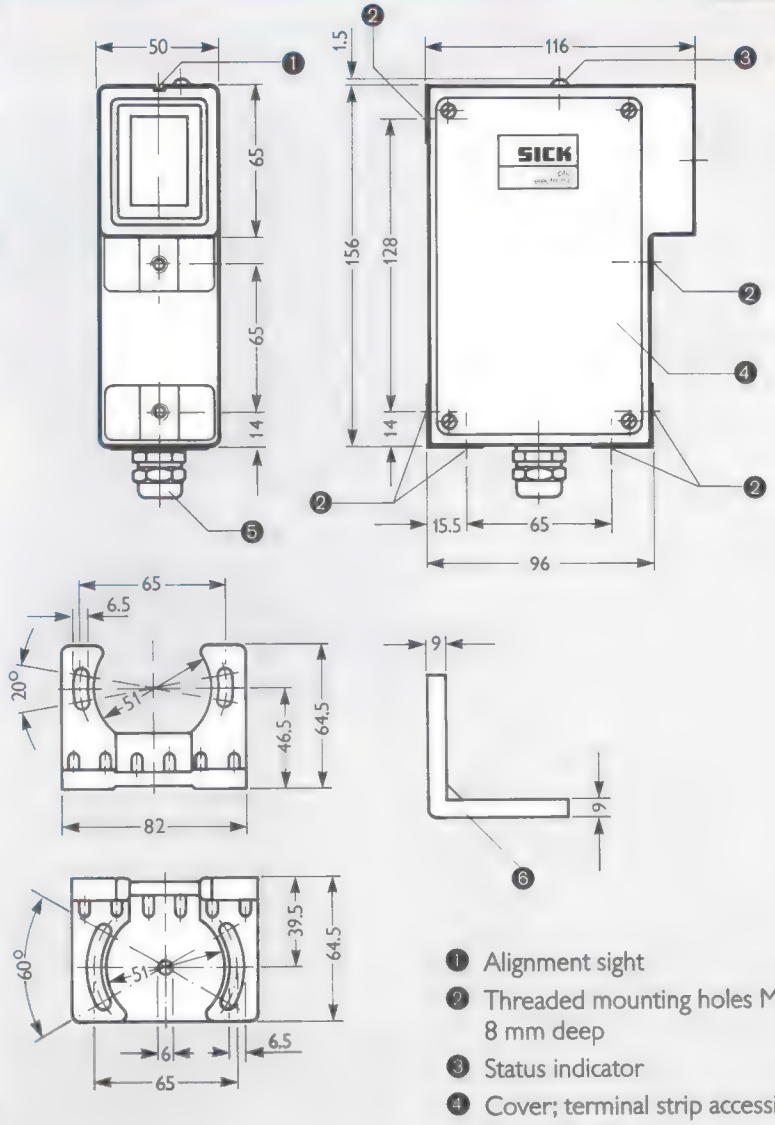
17 m

Features

- Classification EEx ib II C T 6, PTB No. Ex-81/2011
- Status-dependent control current (in accordance with NAMUR and DIN 19234)
- Light-switching
- Adjustable sensitivity
- Status indicator
- Die-cast housing

WL 25 Exi

Dimensions in mm

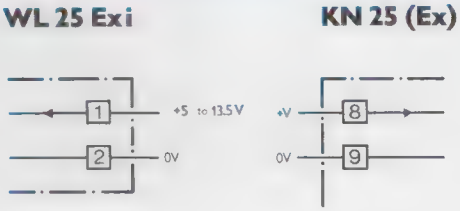


For dust shield (accessories), Part No. 1003 556, see page 152.

For snow shield (accessories), Part No. 1003 619, see page 152.

1. Alignment sight
2. Threaded mounting holes M 6, 8 mm deep
3. Status indicator
4. Cover; terminal strip accessible from this side
5. PG 9 cable gland (for cable diameter 5 to 10 mm)
6. Mounting bracket (included), Part No. 4009 080

Connection Diagram



WL 25 Exi
Photoelectric Reflex Switch

WL 25 Exi	
Part No.	1004116
Type of connection[1])	terminal chamber
Scanning distance[2])	
With PL 80 reflector	25/16 m
With PL 50 reflector	17/10 m
Supply voltage V_S	8.2 (5.0 to 13.5) VDC[3])
Current consumpt. (uninterrupted beam)	≧2.2 mA
Current consumpt. (beam interrupted)	≦1.0 mA
Ripple[4])	≦0.43 V_{pp}
Light source	LED, infrared, modulated, average service life approx. 100,000 h[5])
Light spot diameter	approx. 100 mm at a distance of 6 m
Light receiver switching mode	light-switching
Sensitivity	adjustable
Status indicator	LED, red
Switching outputs	status-dependent control current (in acc. with NAMUR and DIN 19234)
Response time; switching frequency[6])	≦5 ms; max. 100/s
Enclosure rating	IP 67
Explosion protection	E Ex ib IIC T6
PTB No.	Ex-81/2011
Circuit protection	supply connections reverse-polarity protected; interference suppression
Ambient operating temperature	−40 to +75 °C
Storage temperature	−40 to +75 °C
Weight	approx. 950 g

1) Supply via KN 25 (Ex) isolation switching amplifier
2) Typical limiting scanning distance (laboratory value) / recommended normal-service scanning distance under industrial conditions
3) Limit values
4) Must be within V_S tolerances
5) At room temperature = +25 °C
6) With light/dark time ratio of 1:1

Physikalisch-Technische Bundesanstalt

KONFORMITÄTSBESCHEINIGUNG

PTB Nr Ex-81/2011

Diese Bescheinigung gilt für das elektrische Betriebsmittel

Lichtschranke Typ WL 25 Ex

der Firma Erwin Sick GmbH
D7808 Waldkirch

Die Bauart dieses elektrischen Betriebsmittels sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Konformitätsbescheinigung festgelegt

Die Physikalisch-Technische Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 der Richtlinie des Rates der Europäischen Gemeinschaften vom 18. Dezember 1975 (76/117/EWG) die Übereinstimmung dieses elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

Elektrische Betriebsmittel für explosionsgefährdete Bereiche

EN 50 014-1977 / VDE 0171 Teil 1/5.78 Allgemeine Bestimmungen
EN 50 020-1977 / VDE 0171 Teil 7/5.78 Eigensicherheit "i"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen Prüfprotokoll festgelegt

Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen

EEx ib II C T6

Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Bescheinigung aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich bestanden wurden

Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6. Februar 1979 (79/196/EWG) gekennzeichnet werden

Im Auftrag

Braunschweig, 30.1.1981

(Dr.-Ing. Schebadat)
Oberregierungsrat

Prüfbescheinigungen ohne Unterschrift und ohne Dienstsiegel haben keine Gültigkeit
Die Bescheinigungen dürfen nur unverändert weiterverbreitet werden
Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt Bundesallee 100 Postfach 3345 D-3300 Braunschweig

Federal Institute of Physics and Technology (PTB)

Conformity Certificate

PTB No. Ex-81/2011

This certificate is valid for the following electrical equipment,

WL 25 Ex photoelectric reflex switch

manufactured by Erwin Sick GmbH
D-7808 Waldkirch
Federal Republic of Germany

The construction of this electrical equipment, as well as the various permissible designs, are described in the Attachment to this Certificate
According to Article 14 of the Standards of the Council of the European Community, dated 18 December 1975 (76/117/EWG), the Federal Institute of Physics and Technology (PTB), as an inspection office, certifies that this electrical equipment is in accordance with the unified European Standards on

Electrical equipment for hazardous areas

EN 50 014-1977 / VDE 0171 section 1/5.78 General regulations
EN 50 020-1977 / VDE 0171 section 7/5.78 Intrinsically safe, "i"

following successful design testing. The results of this testing are recorded in a confidential test record

The equipment must be labelled as follows:

EEx ib II C T6

The manufacturer is responsible that the construction of all equipment so marked agree with the test documents listed in the Attachment and that the prescribed unit tests have been successfully completed

The electrical equipment may be identified with the distinctive marking printed here, in accordance with Supplement II to the council guidelines of February 6, 1979 (79/196/EWG)

(authorized signature) Braunschweig, 30 Jan. 1981

(stamped with the official seal of the Federal Institute of Physics and Technology)

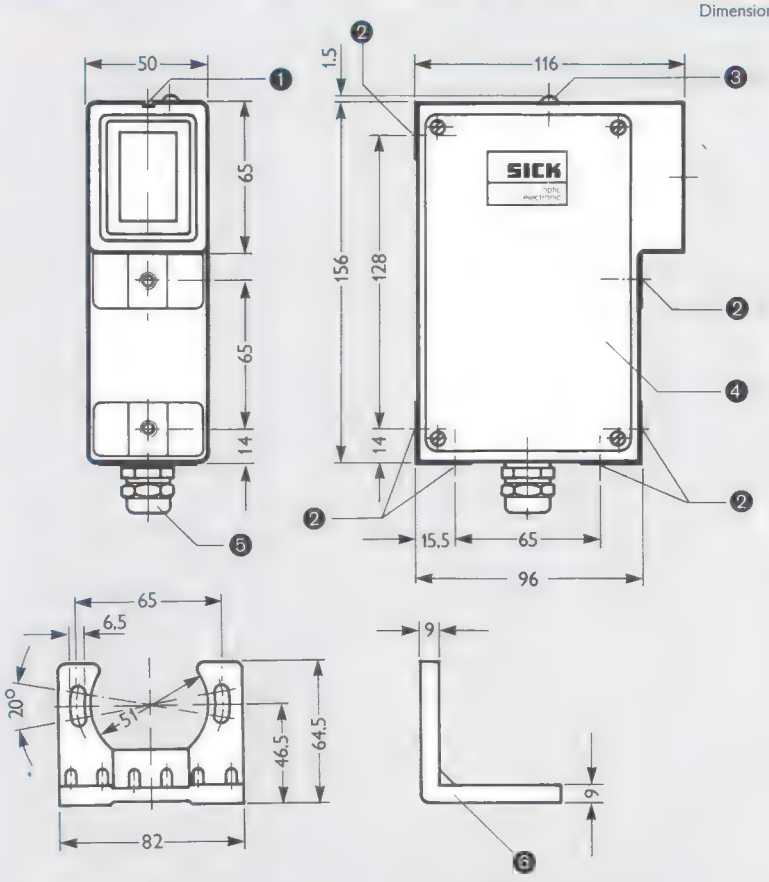
Scanning Range

Features

- Classification EEx ib II C T 6, PTB No. Ex-81/2185
- Status-dependent control current (in accordance with NAMUR and DIN 19234)
- Light-switching
- Adjustable sensitivity
- Status indicator
- Die-cast housing

WT 25 Exi

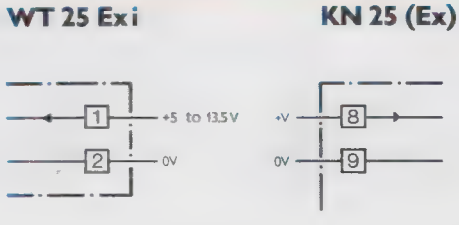
Dimensions in mm



1. Alignment sight
2. Threaded mounting holes M 6, 8 mm deep
3. Status indicator
4. Cover; terminal strip accessible from this side
5. PG 9 cable gland (for cable diameter 5 to 10 mm)
6. Mounting bracket (included), Part No. 4009 080

For dust shield (accessories), Part No. 1003 556, see page 152.
For snow shield (accessories), Part No. 1003 619, see page 152.

Connection Diagram



WT 25 Exi
Photoelectric Proximity Switch

WT 25 Exi	
Part No.	1004673
Type of connection	terminal chamber
Scanning range[1)2)]	0 to 1000 mm / 10 to 650 mm
Supply voltage V_S[3)]	8.2 (5.0 to 13.5) VDC[4)]
Current consumpt. (uninterrupted beam)	≧2.2 mA
Current consumpt. (beam interrupted)	≦1.0 mA
Ripple[5)]	≦0.43 V_{pp}
Light source	LED, infrared, modulated, average service life approx. 100,000 h[6)]
Light spot dimensions	approx. 12 x 12 mm² at a distance of 650 mm
Light receiver switching mode	light-switching
Sensitivity	adjustable
Status indicator	LED, red
Switching outputs	status-dependent control current (in acc. with NAMUR and DIN 19234)
Response time; switching frequency[7)]	≦5 ms; max. 100/s
Enclosure rating	IP 67
Explosion protection	E Ex ib IIC T6
PTB No.	Ex-81/2185
Circuit protection	supply connections reverse-polarity protected; interference suppression
Ambient operating temperature	−10 to +40°C
Storage temperature	−25 to +75°C
Weight	approx. 950 g

1) Typical limiting scanning range (laboratory value) / recommended normal-service scanning range under industrial conditions
2) Based on white standard
3) Supply via KN 25 (Ex) isolation switching amplifier
4) Limit values
5) Must be within V_S tolerances
6) At room temperature = +25°C
7) With light/dark time ratio of 1:1

Physikalisch-Technische Bundesanstalt

KONFORMITÄTSBESCHEINIGUNG

PTB Nr Ex-81/2185

Diese Bescheinigung gilt für das elektrische Betriebsmittel
Lichtschranke
Typ WT 25 Ex

der Firma Erwin Sick GmbH
D-7808 Waldkirch

Die Bauart dieses elektrischen Betriebsmittels sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Konformitätsbescheinigung festgelegt

Die Physikalisch-Technische Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 der Richtlinie des Rates der Europäischen Gemeinschaften vom 18 Dezember 1975 (76/117/EWG) die Übereinstimmung dieses elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

Elektrische Betriebsmittel für explosionsgefährdete Bereiche

EN 50 014-1977 / VDE 0171 Teil 1 / 5.78 Allgemeine Bestimmungen
EN 50 020-1977 / VDE 0171 Teil 5/5.78 Eigensicherheit "i"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen Prüfprotokoll festgelegt

Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen

EEx ib IIC T6

Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Bescheinigung aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich bestanden wurden

Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6 Februar 1979 (79/196/EWG) gekennzeichnet werden

Im Auftrag
(Dr.-Ing. Schebaum)
Oberregierungsrat

Braunschweig 7.12.1981

Federal Institute of Physics and Technology (PTB)

Conformity Certificate

PTB No Ex-81/2185

This certificate is valid for the following electrical equipment.

Photoelectric proximity switch, WT 25 Ex i

manufactured by Erwin Sick GmbH
D-7808 Waldkirch
Federal Republic of Germany

The construction of this electrical equipment, as well as the various permissible designs, are described in the Attachment to this Certificate
According to Article 14 of the Standards of the Council of the European Community, dated 18 December 1975 (76/117/EWG), the Federal Institute of Physics and Technology (PTB), as an inspection office, certifies that this electrical equipment is in accordance with the unified European Standards on

Electrical equipment for hazardous areas

EN 50 014-1977 / VDE 0171 Section 1/5.78 General regulations
EN 50 020-1977 / VDE 0171 Section 1/5.78 Intrinsically safe, "i"

following successful design testing. The results of this testing are recorded in a confidential test record.

The equipment must be labelled as follows

EEx ib II C T6

The manufacturer is responsible that the construction of all equipment so marked agree with the test documents listed in the Attachment and that the prescribed unit tests have been successfully completed.

The electrical equipment may be identified with the distinctive marking printed here, in accordance with Supplement II to the council guidelines of February 6, 1979 (79/196/EWG).

(authorized signature) Braunschweig, 7 Dec. 1981

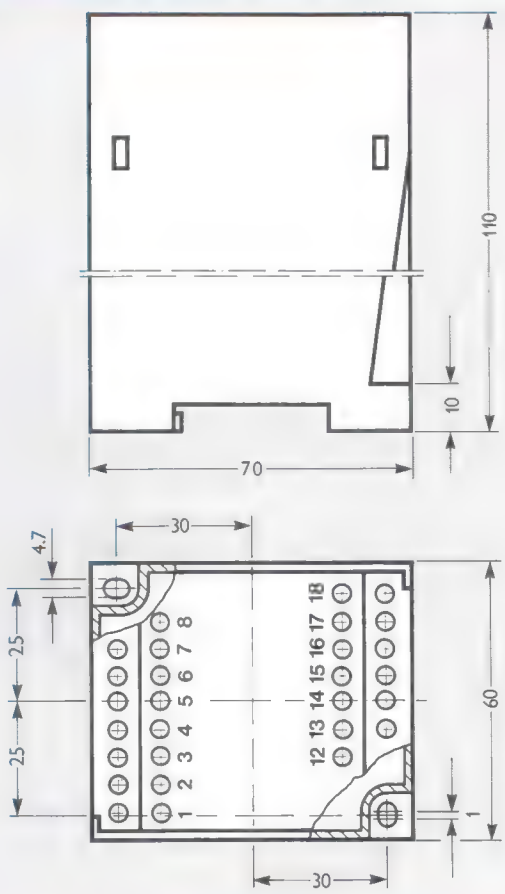
(stamped with the official seal of the Federal Institute of Physics and Technology)

Features

- Power supply and switching amplifier for photoelectric switches and proximity switches to DIN 19234
- Switching amplifier for status-dependent control current
- Light- and dark-switching
- Relay output
- Available with or without time delays
- Separately adjustable time delays
- Classification [EEx ib] IIC, PTB No. Ex-82/2043
- Noryl SEO plastic housing

KN 25 (Ex)

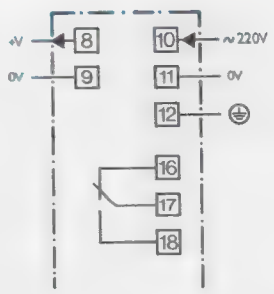
Dimensions in mm



Connection Diagram

KN 25 (Ex)

WT 25 (Ex)
WL 25 (Ex)



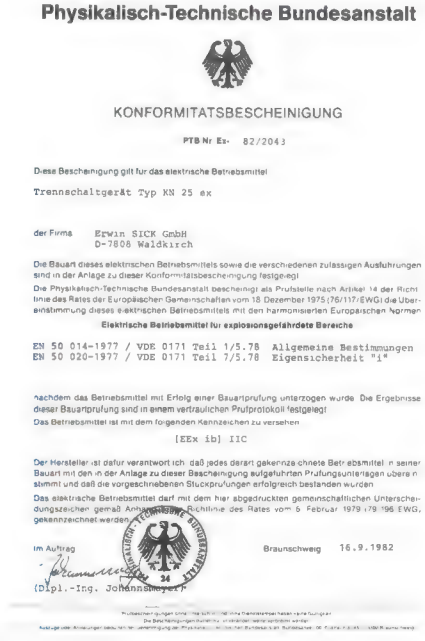
Note
The device must only be operated outside explosion-prone areas.
The housing is suitable for wall-mounting using two holes, in accordance with DIN 43604, or for snap-on mounting on standard rails, in accordance with DIN 46277. Max. cable cross-section for screw terminals 4 mm²

KN 25 (Ex)
Isolation Switching Amplifier

KN 25 (Ex)	-1	-2
Part No.	1004553	1004554
Supply voltage V_S	220 VAC (–15 to +10%)	
Line frequency	47 to 63 Hz	
Power consumption	3.5 VA	
Fuse	250 VT 0.032 Ex C	
Outputs / inputs for WL/WT 25 Exi	for status-dependent control current	
No-load voltage	8.2 VDC (max. 13.5 V)	
Control	control current ≧2.2 mA / ≦1 mA	
Short circuit current	10 mA (max. 47 mA)	
Permissible external capacitance, max.	660 nF	
Permissible external inductance, max.	13 mH	
Switching output[1])	SPDT, electrically isolated	
Switching voltage max.	250 VAC	
Switching current max.	4 A	
Switching power max.	1000 VA	
Mode: light-switching (L)	jumper, terminals 2–3	
Mode: dark-switching (D)	jumper, terminals 1–2	
Time delay	–	ON- and OFF-delay
Time delays	–	0.1 to 15 s[2])
Separately adjustable with	–	20-turn potentiometer
Explosion protection	[E Ex ib] IIC	
PTB No.	Ex-82/2043	
Enclosure rating	IP 20	
Ambient operating temperature	–10 to +40°C	
Storage temperature	–25 to +75°C	
Weight	270 g	300 g

1) Provide suitable arc suppression with inductive or capacitive loads

2) Min. 10 s



Physikalisch-Technische Bundesanstalt

KONFORMITÄTSBESCHEINIGUNG

PTB Nr Ex- 82/2043

Diese Bescheinigung gilt für das elektrische Betriebsmittel

Trennschaltgerät Typ KN 25 ex

der Firma Erwin SICK GmbH
D-7808 Waldkirch

Die Bauart dieses elektrischen Betriebsmittels sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Konformitätsbescheinigung festgelegt.

Die Physikalisch-Technische Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 der Richtlinie des Rates der Europäischen Gemeinschaften vom 18. Dezember 1975 (76/117/EWG) die Übereinstimmung dieses elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

Elektrische Betriebsmittel für explosionsgefährdete Bereiche

EN 50 014-1977 / VDE 0171 Teil 1/5.78 Allgemeine Bestimmungen
EN 50 020-1977 / VDE 0171 Teil 7/5.78 Eigensicherheit "i"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen Prüfprotokoll festgelegt.

Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen

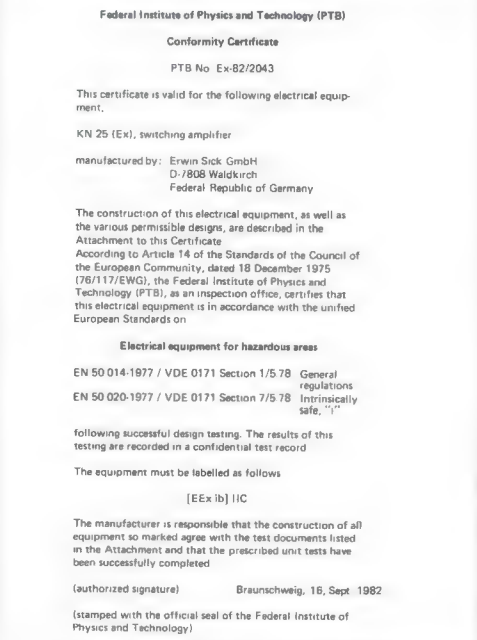
[EEx ib] IIC

Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Bescheinigung aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich bestanden wurden.

Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6. Februar 1979 (79/196 EWG) gekennzeichnet werden.

Im Auftrag Braunschweig 16.9.1982

(Dipl.-Ing. Johannsmeyer)



Federal Institute of Physics and Technology (PTB)

Conformity Certificate

PTB No. Ex-82/2043

This certificate is valid for the following electrical equipment.

KN 25 (Ex), switching amplifier

manufactured by: Erwin Sick GmbH
D-7808 Waldkirch
Federal Republic of Germany

The construction of this electrical equipment, as well as the various permissible designs, are described in the Attachment to this Certificate.
According to Article 14 of the Standards of the Council of the European Community, dated 18 December 1975 (76/117/EWG), the Federal Institute of Physics and Technology (PTB), as an inspection office, certifies that this electrical equipment is in accordance with the unified European Standards on

Electrical equipment for hazardous areas

EN 50 014-1977 / VDE 0171 Section 1/5.78 General regulations
EN 50 020-1977 / VDE 0171 Section 7/5.78 Intrinsically safe, "i"

following successful design testing. The results of this testing are recorded in a confidential test record.

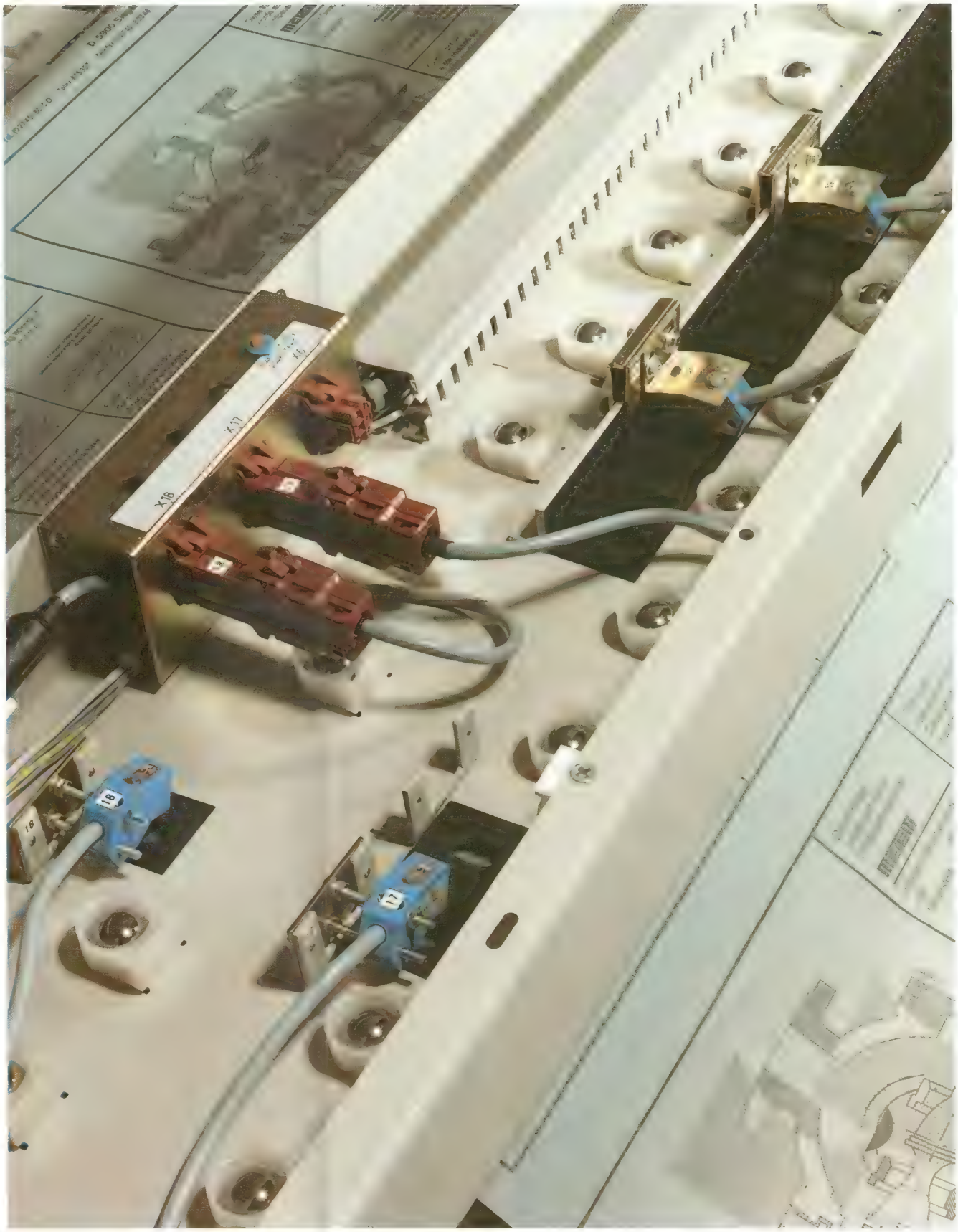
The equipment must be labelled as follows

[EEx ib] IIC

The manufacturer is responsible that the construction of all equipment so marked agree with the test documents listed in the Attachment and that the prescribed unit tests have been successfully completed.

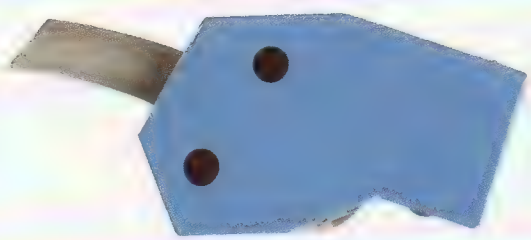
(authorized signature) Braunschweig, 16. Sept. 1982

(stamped with the official seal of the Federal Institute of Physics and Technology)


X18
X17

RP 1-11

9 mm

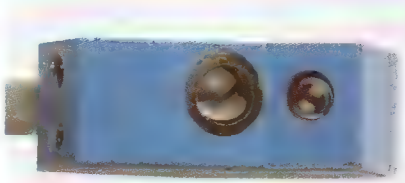


Angled photoelectric switch in metal housing with in-line amplifier in plastic housing. Focussed beam for high switching accuracy.

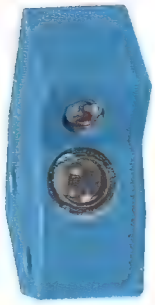
Easily replaceable lamp module.

Enclosure rating IP 65 (dusttight, waterproof); in-line amplifier IP 40. Supply voltage range 10 V to 30 V; incandescent lamp 3 VAC/DC.

Switching output load up to 200 mA. Light-switching. Max. switching frequency 1000/s.



Light beams are focussed at point of intersection of light sender and light receiver.



Scanning Distance

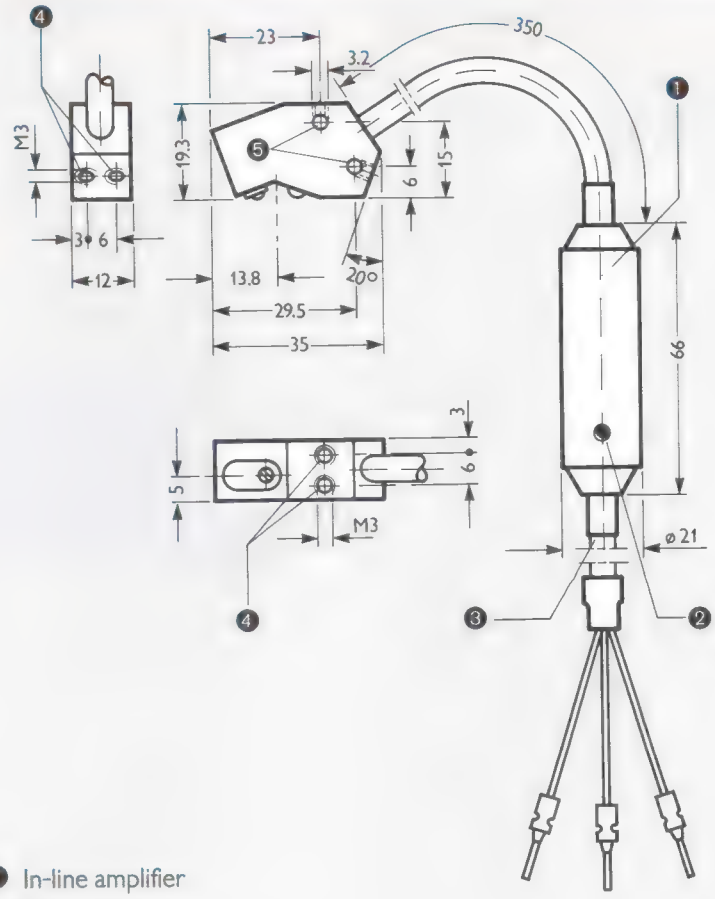
9 mm

Features

- Supply connections reverse-polarity protected
- In-line amplifier
- Light-switching
- Status indicator
- Transistor output short circuit protected
- Simple fitting
- Angular reflection scanner in metal housing
- In-line amplifier in plastic housing

RP 1-1142

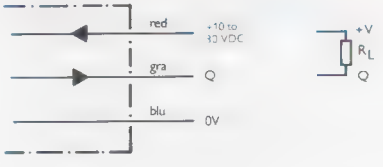
Dimensions in mm



1. In-line amplifier
2. Status indicator
3. Connecting cable, 2 m long
4. Threaded mounting holes M3
5. Mounting holes through enclosure

Connection Diagram

RP 1-11 **NPN**



red	gra	blu
red	gray	blue

RP 1-1142
Angular Reflection Scanner

RP 1	-1142
Type of connection	cable
Scanning distance	9 ± 3 mm
Supply voltage V_S	10 to 30 VDC[1])
Current consumption	60 mA
Ripple max.[2])	4 V_{pp}
Light source	Ga-As-diode, IR, average service life ≧ 100,000 h[3])
Light spot dimensions	approx. 2 x 5 mm^2 at a distance of 9 mm
Light receiver switching mode	light-switching
Status indicator[4])	LED, red
Switching output[4])	NPN
Signal voltage HIGH	approx. V_S
Signal voltage LOW	≦2 V
Switching frequency[5]); output current	max. 1000/s; max. 200 mA
Enclosure rating Scanner	IP 65
In-line amplifier	IP 40
Circuit protection	supply connections reverse-polarity protected; output Q short circuit proof
Ambient operating temperature[6])	−20 to +55 °C
Storage temperature[6])	−20 to +70 °C
Connecting cable	2 m, 3 x 0.14 mm^2, PVC, O.D. 5 mm, shielded signal conductor
Weight	approx. 120 g

1) Limit values
2) Must be within V_S tolerances
3) At room temperature = +25 °C
4) In in-line amplifier
5) With light/dark time ratio of 1:1
6) Do not distort cable below 0 °C
Switching amplifiers for mains connections: KN 1, BP/NP

212 | PFK 1 final positioner provides precise positioning in a fully automatic high-bay warehouse

PFK 1
Final Positioner

PFK 1

400 mm

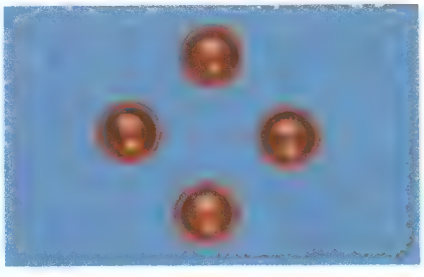
The PFK 1 final positioner is a special photoelectric reflex switch which is suitable as a control device for drives in delivery systems, loading platforms, etc. The PFK 1 undertakes fine positioning after the central control system has executed preliminary positioning. Alignment is performed using a reflector attached to the target object.

The switching point has a reproducibility of ±0.25 mm.

Up to 0.5 m/s is permitted as the relative speed in relation to the reflector.

The reception area at a 300 mm scanning distance is 90 x 90 mm^2 (120 x 120 mm^2 on PFK 1-2).

Four light emitting diodes indicate the possible switching functions (positions) in the four quadrants. A further LED indicates that a reflector is present in the field of vision. An inhibit input is used for inhibition and release of the fine positioning.



Four light emitting diodes indicate the possible positions of the positioner in relation to the reflector.

The device is largely insensitive to reflecting surfaces, thereby permitting reliable detection of the reflector, even on a galvanized background.

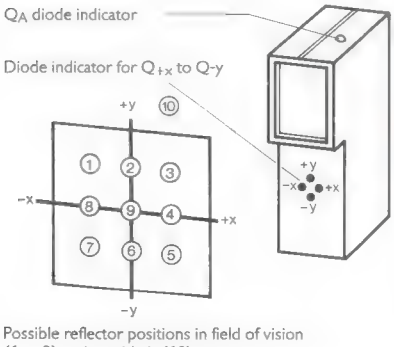
Terminal chamber and cable connection; enclosure rating IP 67 (dusttight, watertight).

Scanning Distance

400 mm

Features

- Insensitive to reflecting surfaces, thereby reliable detection of reflector, even on galvanized background
- Switching output short circuit proof
- Supply connections reverse-polarity protected
- Metal housing
- High positioning accuracy in four quadrants



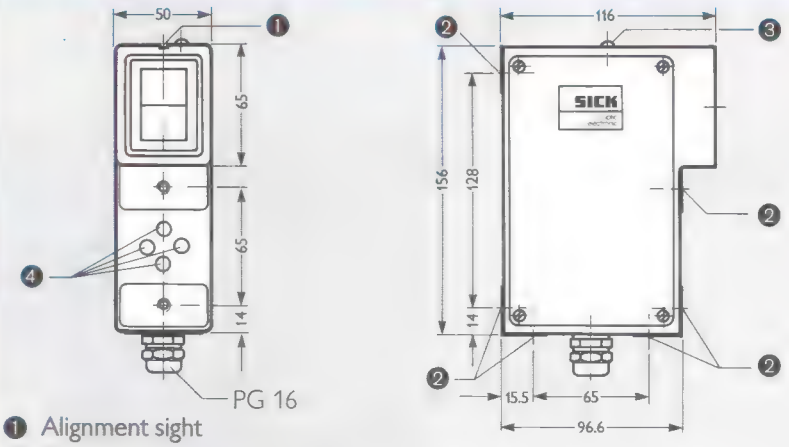
Possible reflector positions in field of vision (1 to 9) and outside it (10)

Position	E/I	Q_{+x}	Q_{-x}	Q_{+y}	Q_{-y}	Q_A
1	H	L	H	H	L	L
2	H	L	L	H	L	L
3	H	H	L	H	L	L
4	H	H	L	L	L	L
5	H	H	L	L	H	L
6	H	L	L	L	H	L
7	H	L	H	L	H	L
8	H	L	H	L	L	L
9	H	L	L	L	L	L
10	H	L	L	L	L	H
Δ	L	L	L	L	L	H

Δ = any position

Truth table for the various reflector positions

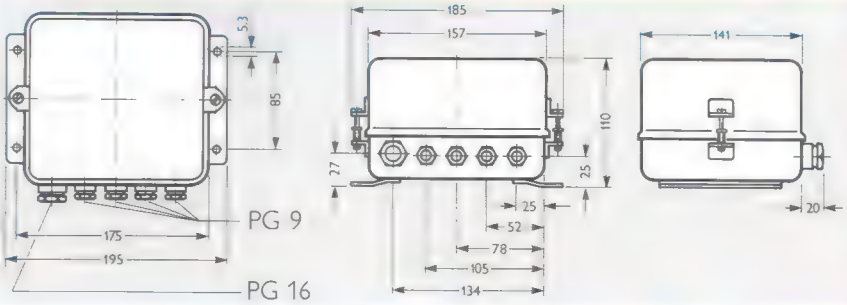
PFK I



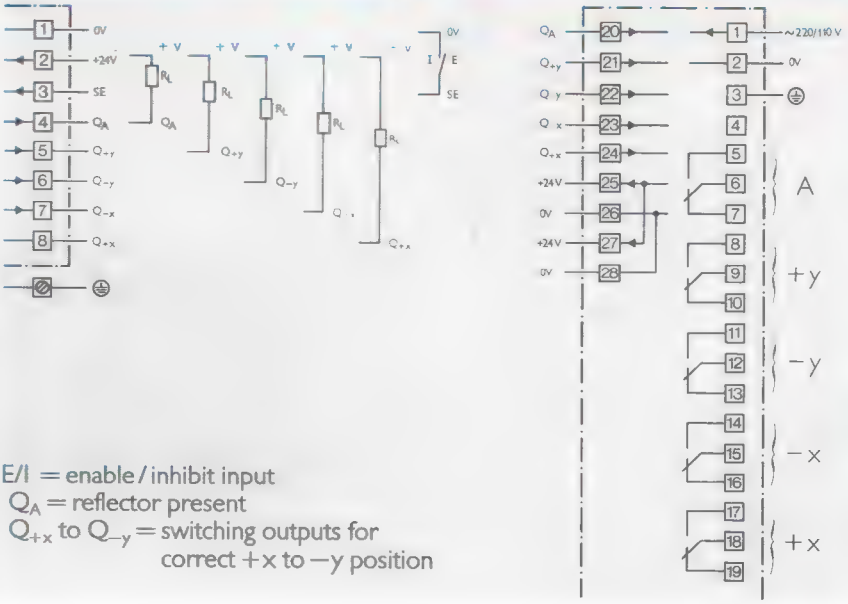
1. Alignment sight
2. Threaded mounting holes M6, 8 mm deep
3. Status indicator: reflector present
4. Status indicator: correct +x, −x, +y, −y position

For mounting bracket (included), Part No. 4009080, see page 147.
For reflectors (accessories), see page 144.

PFN I



Connection Diagram PFK I PFN I



E/I = enable / inhibit input
Q_A = reflector present
Q_{+x} to Q_{-y} = switching outputs for correct +x to −y position

PFK 1 Final Positioner
PFN 1 Switching Amplifier

PFK 1	-1	-2	-3
Part No.	1003297	1004372	1004609
Type of connection	terminal chamber		
Reflectors[1])	Ø 22 mm		
PL 22-1 Part No.	1003546		
PL 22-2 Part No.	1003621		
PL 22-3 Part No.	1003488		
Scanning distance	300 mm, ±100 mm	400 mm, ±100 mm	200 mm, +100 mm, −70 mm
Reproducibility of switching point	± 0.25 mm		
Target-circle diameter for correct position	≦3 mm	5 to 6 mm	
Reception area at 300 mm scann. dist.	90 x 90 mm²	120 x 120 mm²	90 x 90 mm²
Scanning angle	±10° in all axes perpendicular to reflector		
Relative speed in relation to reflector, max.	0.5 m/s		
Supply voltage V_S	24 VDC (±20%)		
Current consumption (no load)	≦150 mA		
Switching outputs	Q_{+x}, Q_{-x}, Q_{+y}, Q_{-y} and Q_A		
Switching current per output	≦100 mA		
Signal voltage HIGH	$+V_S$		
Signal voltage LOW	≦2.5 V		
Inhibit input LOW level (inhibit)	≦3 V		
HIGH level (enable)	≧15 V or not connected		
Perm. potent. diff. between 0V and housing	60 VAC		
Enclosure rating	IP 67		
Ambient operating temperature	−10 to +55 °C[2])		
Storage temperature	−25 to +75 °C		

1) Take nature of mounting into account

2) Account is not taken of the possible formation of condensation on the outside of the objective lens when there is a sudden rise in the ambient temperature and the air humidity is at an appropriate level.

PFN 1	-1	-2
Part No.	1003298	1003530
Supply voltage V_S	220 VAC (+10%, −15%)	110 VAC (+10%, −15%)
Line frequency	48 to 62 Hz	
Power consumption	approx. 11 VA	
Output voltage[1])	24 VDC (max. load) / 35 VDC (no load)	
Alternating-voltage component at max. load	≦2 V_{pp}	
Output current	≦200 mA	
Switching outputs	5 relays, each SPDT	
Relay is energized with	setting with LOW; energizing current 20 mA (DC)	
Switching function for	+x, −x, +y, −y position and reflector in detection range	
Switching voltage / switching current	≦250 V / ≦3 A	
Switching power[2])	≦300 VA	
Switching frequency max.[3])	15/s	
Enclosure rating	IP 64	
Ambient operating temperature	−10 to +55 °C	
Storage temperature	−25 to +75 °C	

1) e.g. for final positioner PFK 1

2) Provide suitable arc suppression with inductive or capacitive loads

3) With scanning ratio of 1:1

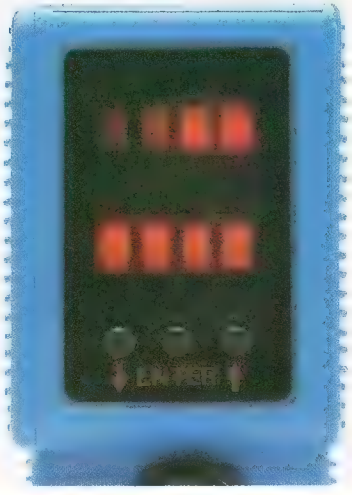
DME 2000
Distance Measuring Device

DME 2000

100 to 2000 mm

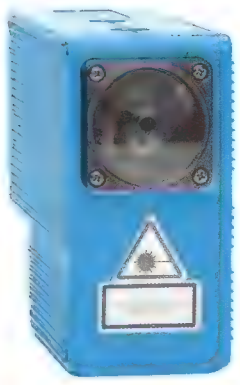
0,1 to 130 m

The DME 2000 is a high-precision opto-electronic instrument. It measures the transit time of light on the phase-correlation principle. It is provided with a red class-2 semi-conductor laser. The 8-digit display indicates the measured value; external further processing of the information is carried out via the serial interface or the analogue current output. Two switching outputs with a freely adjustable switching hysteresis and threshold undertake direct control functions. A convenient menu-guide enables the user to match the parameters to individual automation tasks without difficulty.



Rear view of the DME 2000 showing 8-digit display and programming keys.

Thanks to its opto-electronical functioning principle, the DME 2000 is suitable for a wide variety of applications: e.g. for measuring profiles, the thickness, winding diameter, rotating objects, for determining the height of bulk material or content level (even explosion protection using a bull's eye), for sag sontrol, for measuring stack heights, for non-slip rail locomotive positioning.



Scanning distance

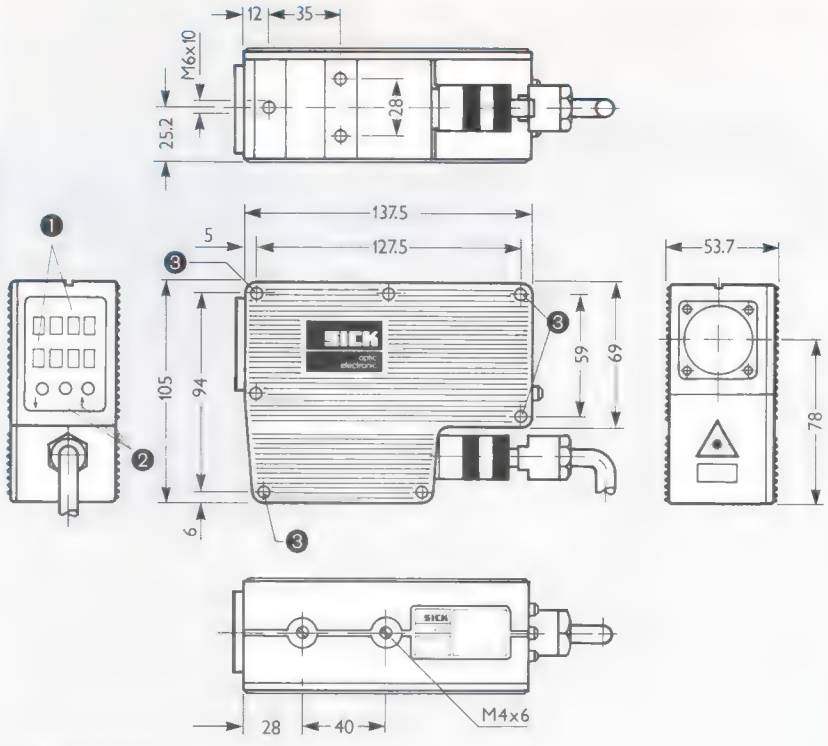
100 to 2000 mm

0.1 to 130 m

Features

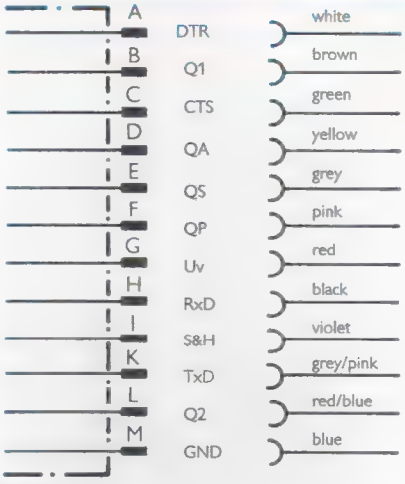
- Distance measurement without any reactive effects
- Light transit-time measurement regardless of the surface
- Compact device, IP 65
- Visible red light used as an alignment aid
- Freely programmable parameters:
  – 2 switching outputs
  switching limit
  – hysteresis
  – offset
  – resolution/measuring rate
  – Scanning/reflector mode
- Serial interface
- 8-digit alphanumeric display
- Analogue output
- Laser class 2

DME 2000



1. 8-digit display
2. Programming keys
3. Mounting holes (rear)

Connection Diagram



Solder side

wht	brn	grn	yel	gra	pink	red	blk	vio	blu
white	brown	green	yellow	gray	pink	red	black	violet	blue

DME 2000
Distance Measuring Device

DME 2000	
Supply voltage V_s	18 to 30 VDC (limit values, reverse-polarity protected)
Ripple	5 V_{ss}
Light source	< 6 W (without load)
Power consumption	Laser-diode (red light), Av. service life 50,000 h (at 25 °C)
Laser protection class	2 (IEC 825 / VDE 0837)
Switching outputs Q_1, Q_2, Q_P, Q_S	PNP
Output voltage	HIGH: V_s – < = 2 V / LOW: 0 V
Output current	$I_{max.}$ = 100 mA, short circuit protected
Capacitive load	$C_{max.}$ = 100 nF
Switching outputs Q_1 en Q_2	can be inverted (Q/Q)
Switching limit	adjustable in mm steps
Switching hysteresis	adjustable in 2-mm steps; 0 to 254 mm
Plausibility output Q_P	HIGH: correct measurement/LOW: measurement error
Service output Q_S	HIGH: system o.k./LOW: Maintenance alarm
Blanking input S/H	HIGH: > = 10 V; < = U_V / LOW: < 2V or blank HIGH: Storing measured values / LOW: unsolicited
Analogue output	0 to 20 mA of 4 to 20 mA
Serial interface	RS 232 (4,8 / 9,6 kBaud)
Enclosure rating	IP 65 (IEC 529)
EM-compatibility	IEC 801, level 3
Ambient temperature	–10 ... +45 °C
Storage temperature	–25 ... +75 °C
Weight	approx. 980 g


SICK

Temperature Measuring Instruments
TM 20

TM 20-1

TM 20-2

TM 20-3

2000 mm

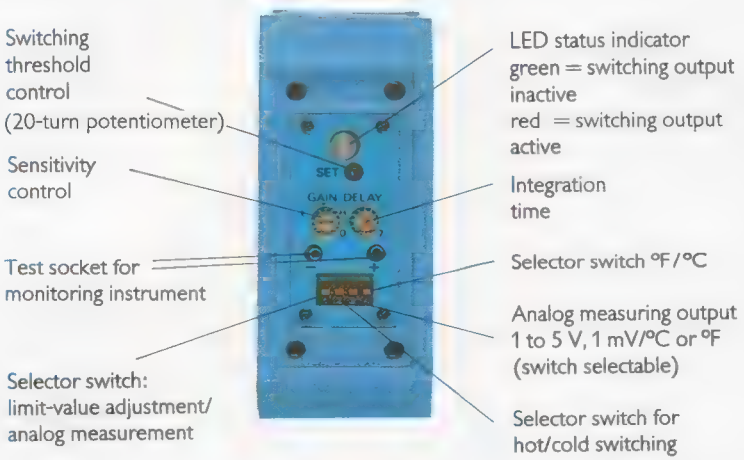
2000 mm

500 mm

Temperature measuring instrument in metal housing with compact dimensions of only 32×77×77 mm.

Models with separate optic head and high enclosure rating; air/water cooler attachment for ambient temperatures up to 150 ° C.

Models with fiber-optic cable for cramped installation conditions; protection against inductive interference; lens adapter for small objects.



The TM 20 is a non-contact temperature measuring instrument which converts infrared radiation from any object into an electrical signal. The instrument is capable of measuring and switching, even with moving objects. Measuring range from 0° C to 2000° C, depending on the model.

Analog measuring output 1 to 5 V, or 1 mV/°C or °F (switch-selectable).

Limit-value output has adjustable switching threshold.

Scanning Distance

2000 mm

Features

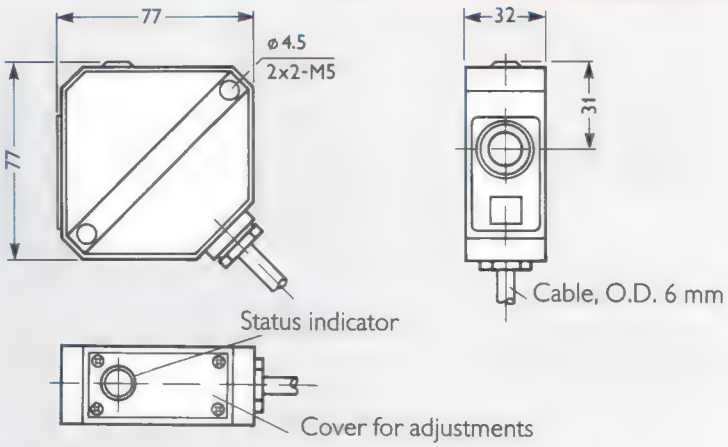
- Built-in amplifier
- Status indicator
- Supply connections reverse-polarity protected
- Photo-MOSFET/opto-coupler switching output for limit value
- Hot/cold switching selector
- Analog measuring output 1 to 5 V, 1 mV/°C or 1 mV/°F (switch-selectable)
- Adjustable amplification factor
- Adjustable integration time
- Temperature range 0 to 500° C or 150 to 500 ° C
- Setting and adjusting elements protected by cover plate
- Sturdy metal housing

Applications

- Particularly suitable for non-metallic surfaces: rubber, plastics, paper, foodstuffs, etc.; equipment incorporates thermopile receiver (7 to 20 µm)
- Equipment with PBSe receiver particularly suitable for metal surfaces, rolls/drums; ceramics industry (1 to 4.8 µm)
- Temperature measurement possible through glass plates

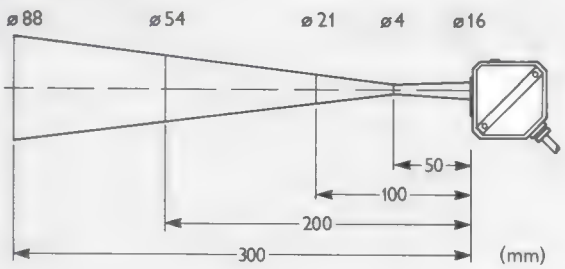
TM 20-I with Incorporated Optics

Dimensions in mm

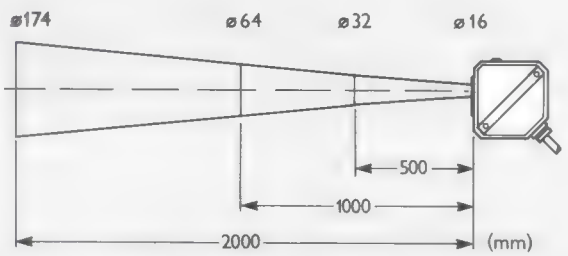


Minimum object size/distance

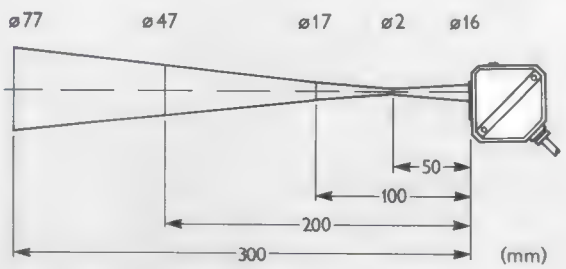
TM 20 – 11112



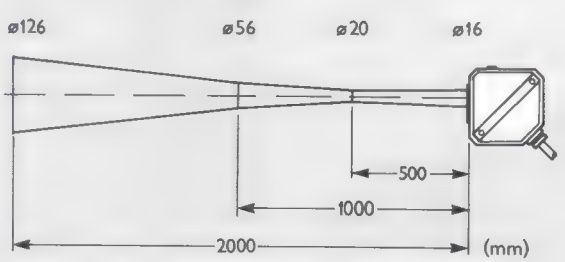
TM 20 – 11122



TM 20 – 11132



TM 20 – 11142



Temperature Measuring Instrument TM 20-1

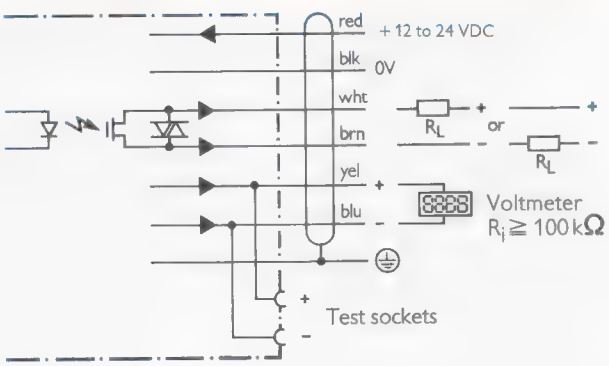
TM 20	-11112	-11122	-11132	-11142
Part No.	6007810	6007811	6007812	6007813
Temperature range	0 to 500 °C		150 to 500 °C	
Min. object size/distance[1]	⌀ 4 mm/50 mm	⌀ 32 mm/500 mm	⌀ 2 mm/50 mm	⌀ 20 mm/500 mm
Supply voltage	12 to 24 VDC ± 10%			
Current consumption	80 mA			
Receiver unit	Thermopile		PbSe	
Wavelength	7 to 20 µm		1.0 to 4.8 µm	
Lens material	Silicon			
Linearity (ε = 1)	±1.5%[2]	±2.0%[2]	±1.5%[2]	±2.0%[2]
Repetition accuracy	±0.2%[2]			
Temperature drift	±0.08%/°C		±0.12%/°C	
Amplification factor	1.0 ± 0.8 (variable)			
Analog output	1 to 5 V, 1 mV/°C or 1 mV/°F (switch-selectable)			
Response time (95%)	0.5 s		80 ms	
Integration time	0 to 7 s (variable)			
Limit-value switching output	Photo-MOSFET / opto-coupler switch / 200 mA / 30 VDC			
Enclosure rating	IP 66			
Vibration resistance	3 g (20 to 50 Hz)			
Permissible ambient temperature	0 to 50°C			
Storage temperature	−20 to + 60°C			
Rel. humidity	Max. 85% without condensation			
Weight	350 g			
Connecting cable	2 m, 6 x 0,25 mm², ⌀ 7 mm			
Accessories (included)	1 mounting bracket			

1) See diagram opposite for other scanning distance and minimum object sizes

2) Based on measured values in Kelvin

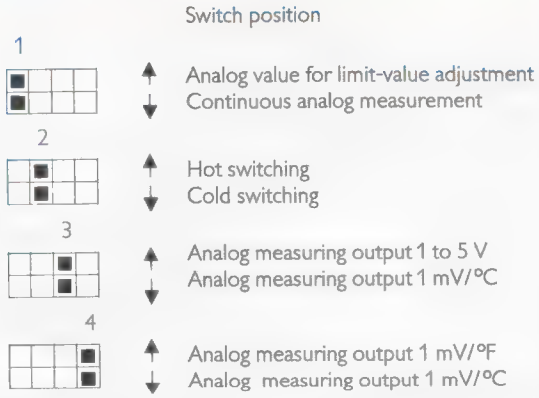
Connection diagram

TM 20



red	blk	wht	brn	yel	blu
red	black	white	brown	yellow	blue

Mode selector



Hot switching: limit-value switching output active above selected switching threshold

Cold switching: limit-value switching output active below selected switching threshold

Scanning Distance

2000 mm

Features

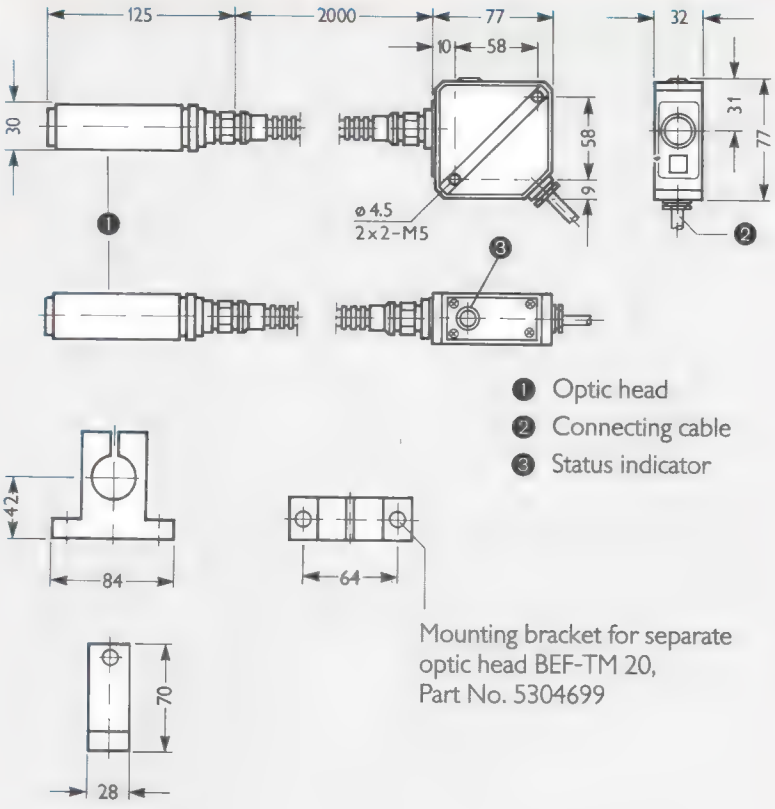
- Built-in amplifier
- Status indicator
- Supply connections reverse-polarity protected
- Photo-MOSFET/opto-coupler switching output for limit values
- Hot/cold switching selector
- Analog measuring output 1 to 5 V, 1 mV/°C or 1 mV/°F (switch-selectable)
- Adjustable amplification factor
- Adjustable integration time
- Temperature range 0 to 500° C
- Setting and adjusting elements protected by cover plate
- Sturdy metal housing
- Separate optic head
- Air/water cooler as accessory
- Designed for high mechanical and thermal stresses

Applications

- Particularly suitable for non-metallic surfaces at high ambient temperatures, like the TM 20-1
- Metal surfaces up to 500°C
- Drying ovens

TM 20-2 with Separate Optic Head

Dimensions in mm

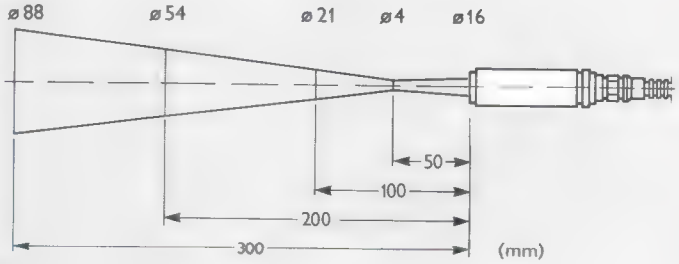


1 Optic head
2 Connecting cable
3 Status indicator

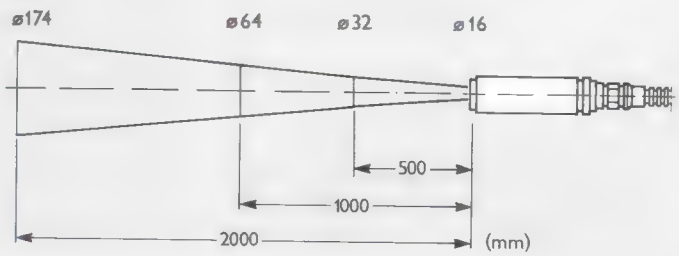
Mounting bracket for separate optic head BEF-TM 20, Part No. 5304699

Minimum object size/distance

TM 20 – 21112



TM 20 – 21122



TM 20-2 Temperature Measuring Instrument with Separate Optic Head

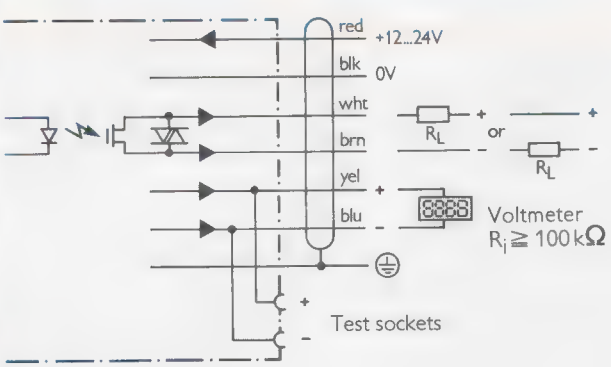
TM 20	-21112	-21122
Part No.	6007814	6007815
Temperature range	0 to 500 °C	
Min. object size/distance[1]	ø4mm / 50mm	ø 32 mm / 500 mm
Supply voltage	12 to 24 VDC ± 10%	
Current consumption	80 mA	
Receiver unit	Thermopile	
Wavelength	7 to 20 µm	
Lens material	Silicon	
Linearity (ε = 1)	±1.5%[2]	
Repetition accuracy	±0.2%[2]	
Temperature drift	±0.08%/°C	
Amplification factor	1.0 ± 0.8 (variable)	
Analog output	1 to 5 V, 1 mV/°C or 1 mV/°F (switch-selectable)	
Response time (95%)	0.5 s	
Integration time	0 to 7 s (variable)	
Limit-value switching output	Photo-MOSFET / opto-coupler / 200 mA / 30 VDC	
Enclosure rating	Separate optic head: IP 66; electronics: IP 65	
Vibration resistance	3 g (20 to 50 Hz)	
Permissible ambient temperature	0 to 50°C (0 to 150°C with water cooling)	
Storage temperature	−20 to +60°C	
Rel. humidity	Max. 85% without condensation	
Weight	800 g	
Connecting cable	2 m, 6 x 0.25 mm², O.D. 6 mm	

Accessories
Mounting bracket (included)
Mounting bracket for optic head BEF-TM 20, Part No. 5304699
Air/water cooler attachment for optic head SLV-TM 20, Part No. 5304698, see page 228
Air/water cooler permits ambient temperature up to max. of 150°C

1) See diagram opposite for other scanning distances and minimum object sizes 2) Based on measured values in Kelvin

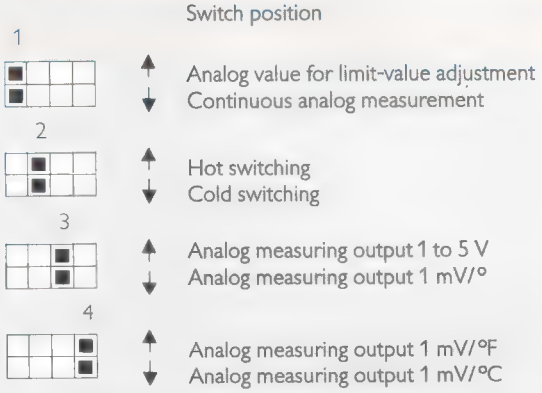
Connection Diagram

TM 20



red	blk	wht	brn	yel	blu
red	black	white	brown	yellow	blue

Mode selector



Hot switching: limit-value switching output active above selected switching threshold

Cold switching: limit-value switching output active below selected switching threshold

Scanning Distance

500 mm

Features

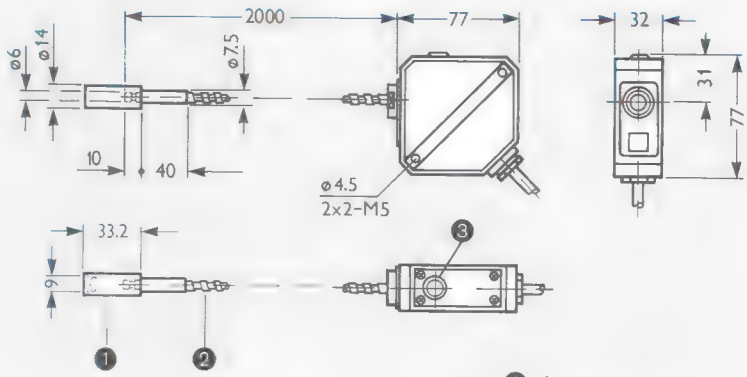
- Built-in amplifier
- Status indicator
- Supply connections reverse-polarity protected
- Photo-MOSFET/opto-coupler switching output for limit value
- Hot/cold switching selector
- Analog measuring output 1 to 5 V, 1 mV/°C or 1 mV/°F (switch-selectable)
- Adjustable amplification factor
- Adjustable integration time
- Temperature range 400 to 800 °C, 600 to 1200 °C, 1000 to 2000 °C
- Setting and adjusting elements protected by cover plate
- Sturdy metal housing
- Fiber-optic cable design
- For inductive environments
- Small space requirement
- Lens adapter for small objects (accessory)
- Fiber-optic cable thermally stable < 150 °C

Applications

- For high material temperatures
- Metal surfaces
- Particularly suitable for use in aluminium processing industry
- For small objects

TM 20-3 with Fiber-optic Cable

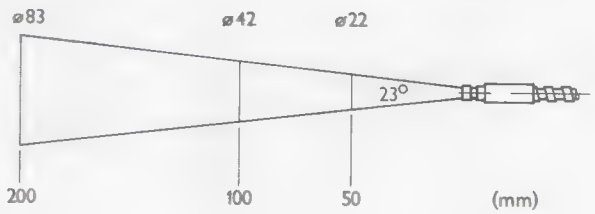
Dimensions in mm



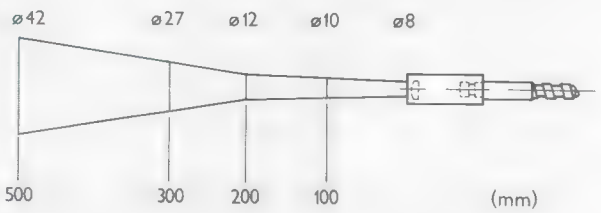
❶ Lens adapter
❷ Fiber-optic cable
❸ Status indicator

Minimum object size/distance

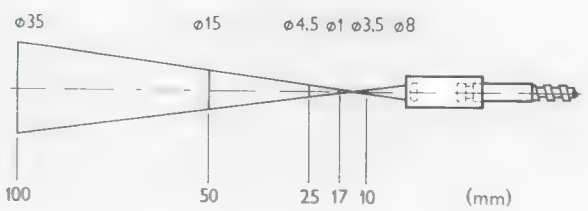
TM 20-3



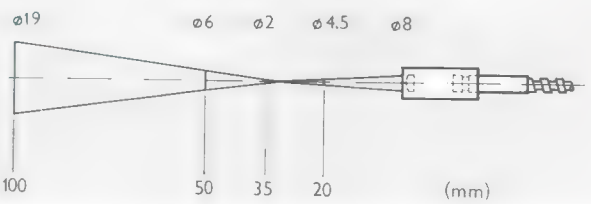
TM 20-3
with BF-TM 2012,
Part No. 5304697



BF-TM 2001,
Part No. 5304792



BF-TM 2002,
Part No. 5304793



TM 20-3 Temperature Measuring Instrument with Fiber-optic Cable

TM 20	-31182	-31162	-31172
Part No.	6007942	6007817	6007818
Temperature range	400 to 800 °C	600 to 1200 °C	1000 to 2000 °C
Min. object size / distance[1]	ø 12 mm / 200 mm with BF-TM 2012		
Supply voltage	12 to 24 VDC ± 10%		
Current consumption	50 mA		
Receiver unit	PbS	Ge	
Wave length	1.0 to 1.6 µm		
Lens material	BK-7 glass lens		
Linearity (ε = 1)	±2.0%[2]	±1.5%[2]	
Repetition accuracy	±0.2%[2]		
Temperature drift	±0.1% / °C	±0.04% / °C	
Amplification factor	1.0 ± 0.8 (variable)		
Analog output	1 to 5 V, 1 mV / °C or 1 mV / °F (switch-selectable)		
Response time (95%)	3 ms	5 ms	
Integration time	3 to 700 ms	5 to 50 ms	
Limit-value switching output	Photo-MOSFET/switch / 200 mA / 30 VDC		
Enclosure rating	Fiber-optic cable: IP 66; electronics: IP 65		
Vibration resistance	3 g (20 to 50 Hz)		
Permissible ambient temperature	0 to 150°C (fiber-optic cable) and 0 to 50°C (electronics)		
Storage temperature	−20 to +60°C		
Rel. humidity	Max. 85% without condensation		
Weight	400 g		
Connection cable	2 m, 6 x 0.25 mm², O.D. 7 mm		

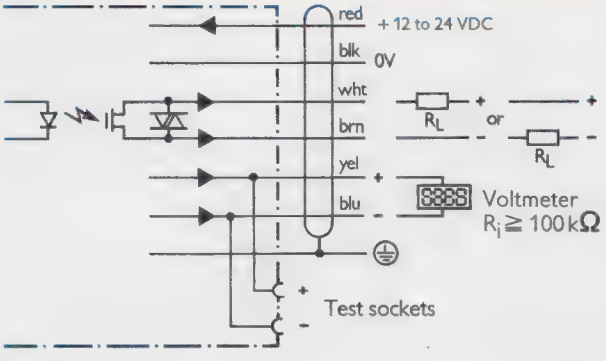
Accessories
Mounting bracket (included)
BF-TM 20 lens adapters (see diagram opposite)

1) See diagram opposite for other scanning distances and minimum object sizes

2) Based on measured values in Kelvin

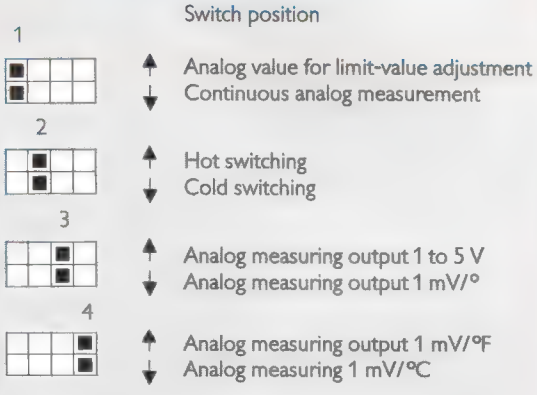
Connection Diagram

TM 20



red	blk	wht	brn	yel	blu
red	black	white	brown	yellow	blue

Mode selector



Hot switching: limit-value switching output active above selected switching threshold

Cold switching: limit-value switching output active below selected switching threshold

Accessories

Mounting bracket for TM 20 (included)

Air/water cooler attachment for TM 20-2 (incl. mounting bracket) SLV-TM 20, Part No. 5304698

Air cooling

for ambient temperatures from 35 to 80°C

Air flow rate 50 to 150 Nl/min

Air inlet temperature 20°C

Air pressure ≦ 2 bar

Water cooling

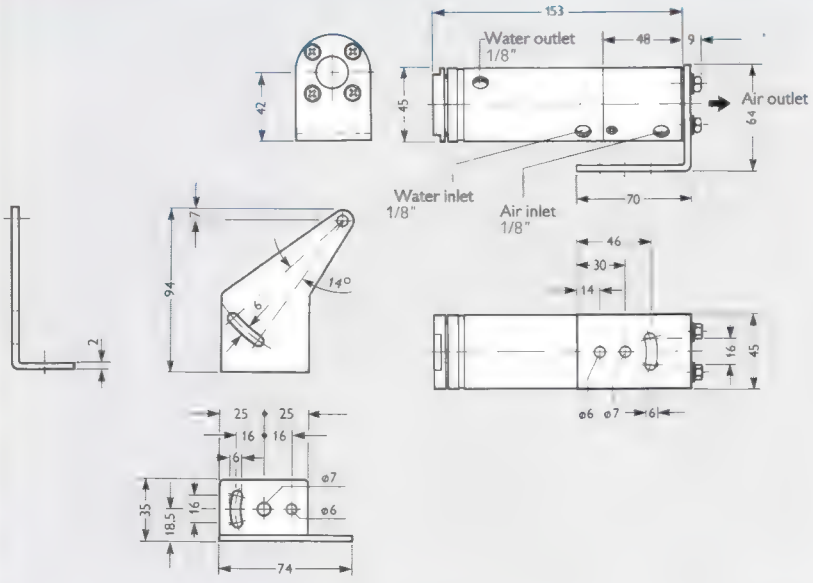
for ambient temperatures from 80 to 150°C

Water flow rate 0.5 to 2 l/min

Water inlet temperature 30°C

Water pressure ≦ 1 bar

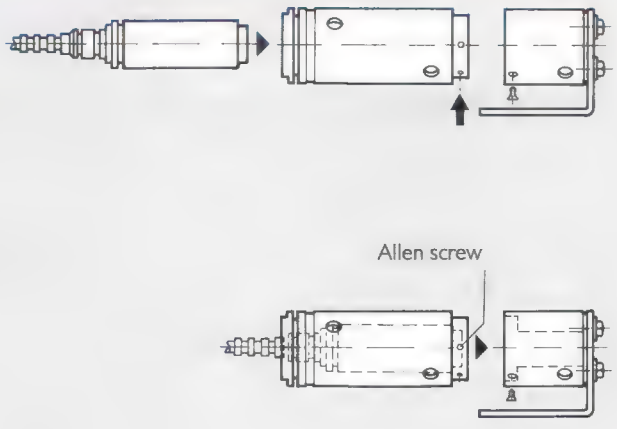
Dimensions in mm



Fitting instructions

Allen keys (1.5) for M3 screws Part No. 3502672

- Remove cooler housing after undoing the three Philips screws.
- Insert BS sensor into air/water cooler housing. Insertion is tight because of the O-rings. Mounting can be facilitated by appropriate greasing of the O-rings
- Insert sensor as far as it will go and secure with the three M3 Allen screws(1.5 Allen key)
- Refit cooler housing and tighten Philip screws

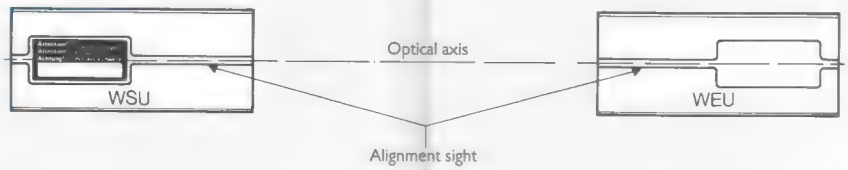


Definitions

Definitions

Alignment

With through-beam photoelectric switches, the sender and receiver should first of all be provisionally fitted. The devices should then be aligned in relation to each other, using the alignment sights. The sender is then pivoted horizontally until the signal strength indicator (or status indicator) is positively lit (light-switching) or positively off (dark-switching). The sender should be tightened up in the middle of the reception range thus determined. The optical axis of the opposed devices should be as identical as possible.



Alignment of through-beam photoelectric switches using the alignment sight

With photoelectric reflex switches, the device should first of all be provisionally fitted. The reflector should be mounted within the normal-service scanning distance, at right angles to the center of the optical axis of the device. The switch should then be pivoted horizontally and vertically until the signal strength indicator (or status indicator) is positively lit (light- switching) or positively off (dark- switching). The switch should then be tightened up.

Alignment Insensitivity

Whereas mirrors used as reflectors permit hardly any angular error, reflectors consisting of triple prisms permit angular errors of up to ±15° in relation to the perpendicular to the direction of radiation.

Alignment Sight

Notch at the top of a device to facilitate alignment.

Ambient Light

Light from an extraneous source, in addition to light radiated by the light source of the photoelectric device onto the place being detected or into the device.

Angular Reflection Scanner

A photoelectric proximity switch in which the optical axes of the light sender and light receiver form an angle (DIN 440 30).

Autocollimation

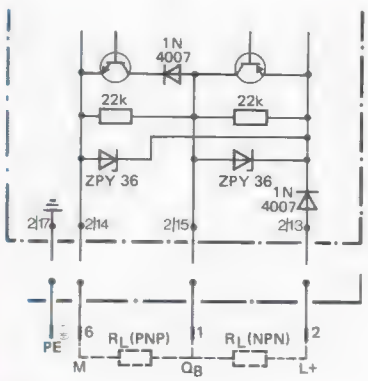
Reflecting principle in which a light beam striking a reflector is reflected parallel to itself ("into itself").

Background Suppression

Using a photoelectric method, the scanner only detects material surfaces within a defined scanning range. Objects outside that range are not detected.

B Configuration

Output circuit permitting both NPN and PNP configurations, even at the same time. In contrast to an NPN configuration and PNP configuration, the output signal is neither approx. 0 V in the case of LOW, nor approx. +V in the case of HIGH. The transistor blocking voltage of approx. 1 V is always present.



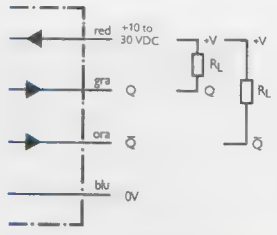
The B output can be operated both in NPN and PNP configurations.

Blinking Threshold

Response boundary at which the signal strength indicator starts to blink, thereby indicating a situation below the 50% operating margin/ reserve.

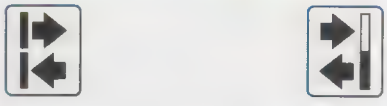
Complementary

Complementary switching outputs Q and $\overline{Q}$ can be used as light- and dark-switching outputs. When one signal is HIGH, the other is LOW.



Complementary switching outputs in NPN configuration

Contrast Scanner



Contrast scanners work according to the photoelectric proximity switch principle and are capable of detecting up to 15 different gray scale values between black and white.

Dark-switching

The switching output of a photo-electric device is activated (e.g. an output relay operated) when no light strikes the light receiver.
With dark-switching, if the light receiver is not illuminated, the subsequent amplifier is "switched through" and the output relay is energized (pulled in). When the light receiver is illuminated, the relay is de-energized (dropped out).

	Status indicator	Relay	Output Q PNP	NPN
Un-interrupted beam	⊗	OFF	LOW	HIGH
Interrupted beam	⊗	ON	HIGH	LOW

"Dark-switching" truth table

Diaphragm - Mask

Mechanical component limiting beam-area.

Diffuse Reflection

Undirected return of radiation from non-mirroring surfaces.

Enclosure Rating

Classification of the protection of electrical equipment from electric shock, foreign bodies and water (DIN 400 50). A device with the rating IP 67 is completely safe against electric shocks, as well as being dusttight and watertight (immersion). IP 65, on the other hand, is safe against electric shocks and dusttight, but in relation to water it is only protected against sprayed water (from a nozzle), and not against immersion.

Explosion (Ex) Protection

Explosion protection required for devices in atmospheres prone to explosions.

Fiber-optic Cable

Bundle of glass or plastic fibers in which light can be conducted. Ideal applications include constricted areas and critical ambient conditions.

Filter

Optical filters only let through light waves in particular wavelength ranges and block other wavelength ranges.

Electrical filters only let through signals in particular frequency ranges and block other frequency ranges.

Incandescent Light

(Constant Light)

Light with a largely constant radiation capacity (e.g. an incandescent lamp). The advantage of a relatively high light intensity is offset by the disadvantage of a "sluggish" behaviour which rules out modulation or pulsing of the light.

Incandescent-light Operation

Operation of a photoelectric switch or proximity switch, in which the constant-light component of the luminous flux is evaluated in the light receiver.

Infrared (IR)

Radiation with a longer wavelength than visible light, with wavelengths between 0.75 µm and 100 µm.
IR sender-diodes radiate in the infrared-A range with a wavelength of approx 0.8 to 0.95 µm.

Life

The life of an LED or an incandescent lamp is defined as the time it takes to drop to half-power. In the case of an LED the value is related to an ambient operating temperature of +25°C. With an incandescent lamp for the specified operating voltage, lamp-life is reduced to one quarter by a 10% overvoltage and is extended by a factor of 4 by a 10% undervoltage.

Light Spot

Reproduction of the illumination area of the light source at a plane perpendicular to the optical axis.

Definitions

Light-switching

When a photoelectric device is set at "light-switching", the switching output is active (e.g. a relay is energized) when light strikes the receiver. In through-beam and reflex applications this is the case when the beam is uninterrupted; in proximity applications, when the material being scanned is present.

If the light receiver is illuminated in light-switching mode, this implies that the amplifier has been "switched through" and that the output relay has been energized. The relay drops out when the beam is interrupted.

	Status indicator	Relay	Output Q PNP	NPN
Un-interrupted beam	⩾⊗⩽	ON	HIGH	LOW
Interrupted beam	⊗	OFF	LOW	HIGH

"Light-switching" truth table

Limiting Scanning Distance

Maximum distances between light sender and receiver or between photoelectric reflex switch and reflector. This value is a laboratory value determined with perfectly clean optical surfaces. Limiting scanning distances in the Technical Data are indicated as such.

The "limiting scanning distance" can also apply to the maximum distance between a photoelectric proximity switch and the surface of the material being scanned.

Modulated Light

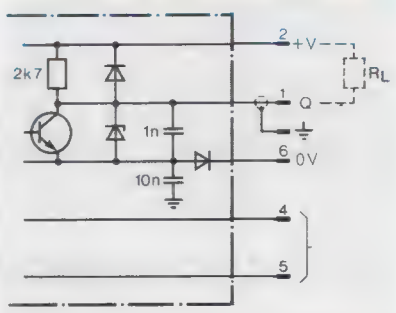
Light with a periodically varying radiation capacity. It involves indicating the light frequency and possibly the waveform (e.g. infrared or modulated).

Modulated-light Operation

Operation in which the modulated light component of the luminous flux is evaluated in the light receiver.

NPN Output

Output stage in which the load is at +V. Only when the output is at LOW potential does current flow through the load (e.g. a relay). If the output potential is HIGH, roughly the operating voltage is applied to the output; when it is LOW, on the other hand, a residual voltage of up to 1 V is applied.



NPN configuration of photoelectric switch output Q

Photoelectric Proximity Switch

An arrangement of one or more light sources illuminating a scanning plane by optical means. The light reflected by an object at the scanning plane is received by one or more photo-electronic components, which convert the luminous-flux variations into an electrical signal (DIN 440 30).

Such devices are commercially available as photoelectric proximity switches (also as registration control scanners) and as angular reflection scanners.

A proximity switch in which the light sender and light receiver are located on the same side of the scanning plane. In the main, the switch detects diffusely reflecting surfaces or objects (DIN 440 30).

The basic condition of the photo-electric proximity switch is with no scanned material present. It switches when material is detected (light-switching).

Switching output	Light-switching (Q)		Dark-switching ($\overline{Q}$)	
Light received[1])	yes	no	yes	no
Signal strength indicator	⩾⊗⩽	⊗	⩾⊗⩽	⊗
Load R_L	energized	de-energized	de-energized	energized
PNP output	HIGH	LOW	LOW	HIGH
NPN output	LOW	HIGH	HIGH	LOW

[1]) = object present

Truth table for a photoelectric proximity switch

Photoelectric Reflex Switch

A photoelectric switch in which the light sender and light receiver are in the same housing. The light from the sender is returned to the receiver by a reflector.

Depending on the type of device, the output signal is switched by a transistor, triac, thyristor or relay stage.

The basic condition of the photoelectric reflex switch is with an uninterrupted beam. It switches when the beam is broken (dark- switching).

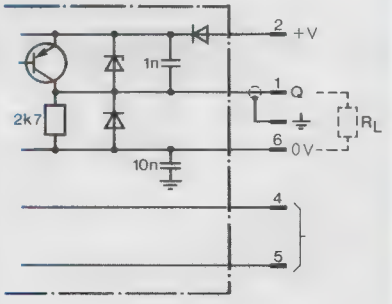
Switching output	Light-switching (Q)		Dark-switching ($\overline{Q}$)	
Light beam	uninterrupted	interrupted	uninterrupted	interrupted
Signal strength indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
PNP output	HIGH	LOW	LOW	HIGH
NPN output	LOW	HIGH	HIGH	LOW

Truth table for a photoelectric reflex switch

PNP Output

Output stage in which the load is at 0 V. Only when the output is at HIGH potential does current flow through the load (e.g. a relay).

If the output potential is LOW, approx. 0 V is present at the output; when it is HIGH, on the other hand, it is approx. 1.5 V short of +V.



PNP configuration of photoelectric switch output Q

Polarized Light

Light which does not oscillate in arbitrary planes, like natural light, but in just one plane.

Polarizing Filter

Filter (e.g. plastic foil with stripes) for producing polarized light.

Power Indicator

An indicator (usually in the form of an LED), which indicates (on the sender of a through-beam photoelectric switch, for example) that the operating voltage is applied.

Red Light

Visible light in the red range between 600 and 780 nm. Red-light sender diodes emit in the red-light range with a wavelength of 630 to 690 nm.

Reflection

Return of radiation impinging on the interface between two media. Directed or mirroring reflection is "mirroring": radiation is sent back in only one direction. If it is returned in a large number of directions, it is described as "diffuse reflection."

Retroreflecting

Description applicable to an optical component which reflects light equally well back to itself, i.e. to the light source, provided the light strikes roughly perpendicularly. Triple reflectors permit a tolerance of ±15°.

Scanning Distance

(Normal-service scanning distance)

Distance between light sender and light receiver or between photoelectric reflex switch and reflector, within which reliable operation of the device concerned is ensured under industrial conditions. A certain amount of dirt on the device does not affect its operation.

Values given in the Technical Data without further amplification are normal-service scanning distances.

Definitions

Signal Strength Indicator

An indicator (generally in the form of an LED), which indicates whether the device has switched, but also indicates by a blinking mode that, say, the signal reserve remaining is only 50%.

The indicator can be used to monitor dirt build-up on the optics, giving timely warning of breakdown of the system. It can also be used for precise alignment of devices.

Light received	Signal strength indicator	Photoelectric switch
good	⋋⊗⋌	switches
margin ≤50%	⋋⊗⋌ (blink.)	switches
none	⊗	does not switch

Truth table for signal strength indicator

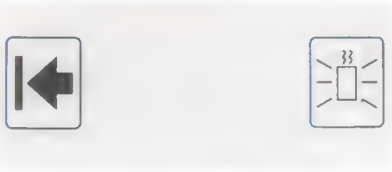
Status Indicator

An indicator (usually in the form of an LED), which indicates that the output stage of the device has switched (e.g. the relay has been energized). A blinking mode as with the signal strength indicator is not possible.

Switching Threshold

Response boundary at which a switching operation is triggered.

Temperature Measuring Instruments

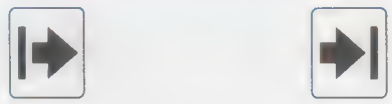


Temperature measuring instruments are non-contact temperature sensors which convert infrared radiation from any object into an electrical signal.

The instrument is capable of measuring and switching, even with moving objects. Measuring range 0 to 2000 °C, depending on the model.

Analogue measuring output 1 to 5 V, 1 mV/°C or F (switch-selectable). Limit-value switching output; adjustable switching threshold.

Through-beam Photoelectric Switch



A photoelectric switch in which the light from the sender is directed towards a receiver which is physically and optically separate from it (DIN 440 30).

Depending on the model, the receiver includes an amplifier and output stage with a transistor output or relay output. Long scanning distances can be achieved with through-beam photoelectric switches. The basic state of the switch is with the beam uninterrupted – it switches when the beam is broken (dark-switching).

Switching output	Light-switching (Q)		Dark-switching ($\bar{Q}$)	
Light beam	uninterrupted	interrupted	uninterrupted	interrupted
Signal strength indicator	⋋⊗⋌	⊗	⋋⊗⋌	⊗
Load R_L	energized	de-energized	de-energized	energized
PNP output	HIGH	LOW	LOW	HIGH
NPN output	LOW	HIGH	HIGH	LOW

Truth table for a through-beam photoelectric switch

Triple Reflector

Pyramid-shaped body whose three side faces form on angle of exactly 90°. Light entering through the base is reflected parallel to itself. Linearly polarized light is also rotated in its polarization plane. Maloperation by "mirroring" material is thereby prevented in a photoelectric reflex switch.

Opto-electronics from SICK

Automated industrial processes call for proven and reliable technologies to solve the nummerous problems.

Light is the perfect medium for the acquisition of data on goods and for the automation of manufacturing processes. It does not affect the environment, it is quick and non-distructive. SICK have been specialising in this technology for more than 40 years and even apart from industry, the company has opened up numerous fields of application.

- Photoelectric switches and proximity switches for automation.
- Safety light curtains and grids for accident prevention at danger points and areas and for guarding entries.
- Emission monitors and analyzers for monitoring pollutant concentrations, special sensors for traffic security.
- Bar code identification systems for the acquisition of process data and for material-flow control.
- Image processing systems and laser scanners for a wide variety of tasks in quality control.

We know the solution to many application problems and offer reliable, high-quality opto-electronical systems and sensors — just contact us.

Automation technology

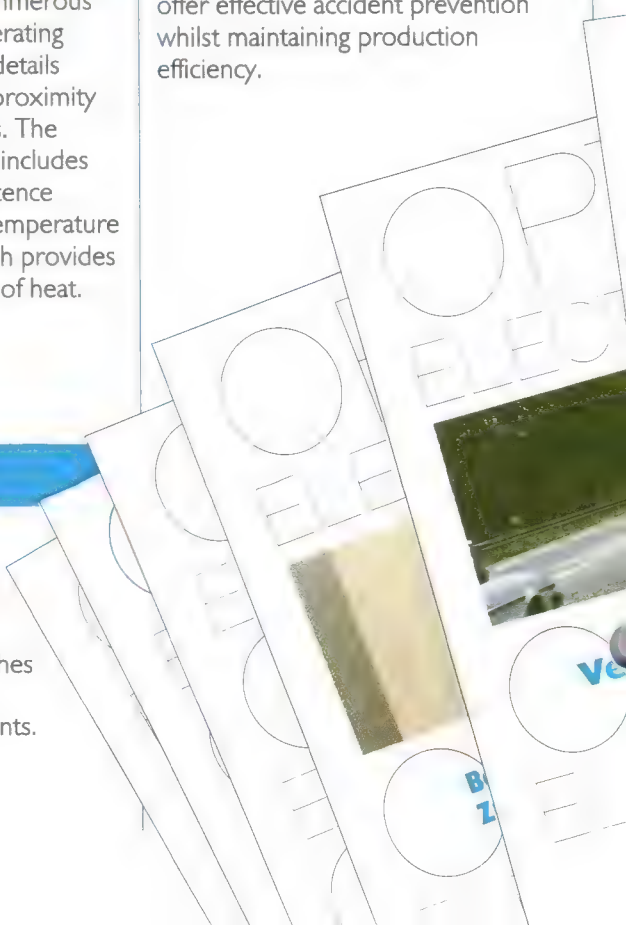
SENSICK photoelectric switches and proximity switches have become essential components in industry. Wherever objects have to be detected reliably, wherever processes must be monitored or controlled — it's SENSICK sensors which are used. And since SENSICK stands for high-quality products, these sensors guarantee cost-effective manufacturing without any problems.

The applications are as nummerous as the ambient and the operating conditions. This catalogue details through-beam, reflex and proximity type photoelectric switches. The range of our products also includes contrast scanners, luminescence scanners and the TM 20 Temperature measuring Instrument which provides non-contact measurement of heat.

Safety Light curtains and grids which reliably guard dangerous machines and plant are also ideal for the protection of areas. Photoelectric safety switches and the OTD rotating-beam light curtain ensure effective access protection.

Entry and exit guarding on doors of public transport vehicles, lifts and within warehouses are areas for which a separate range of products have been developed.

Two special catalogues provide information on how our products offer effective accident prevention whilst maintaining production efficiency.



Safety technology

Opto-electronical safety systems from SICK are used for presence sensing monitoring of danger areas on presses and punches as well as for guarding the access to machines and plants.

Opto-electronics from SICK

Environmental systems

Today, protection of the environment stands in the centre of the public interest and an enormous effort together with reliable control systems are required to keep to the legally

prescribed or recommended limit values. Pollutant concentrations of gases and dust, which are emitted e.g. by large-size furnaces and refuse incinerators, are determined by dust density monitors and gas analyzers from SICK.

SICK traffic sensors help to control traffic and to avoid accidents. They inform on any reduction of visibility — caused by fog, rain, snow etc. — on roads and highways, they record ground visibility at airports and detect visibility and pollutant concentrations in tunnels.

Our catalogues and brochures provide information on the complete range of devices and on typical applications.

Automatic identification

Materials flow is not only controlled by photoelectric switches and proximity switches but also by bar code reading systems which reliably detect the process data. Bar code readers are used for safe data detection and transmission, capable of being synchronized with either rapid processes or a manual process-

orientated operation. SICK offers many solutions from one source: be it an individual portable device or a complete network system.

Dynamic V scanners and parallel scanners are used for a varying height of the reading plane or a varying distance and read all current types of bar codes.

Hand-held bar code readers such as wands and laser scanners, decoders and data terminals with integrated decoders make the range of products complete. Finally, the ISD 100 IR Data Transmission System provides wireless data transmission.

A special catalogue informs you on these systems, on applications and our engineering services for process data detection.

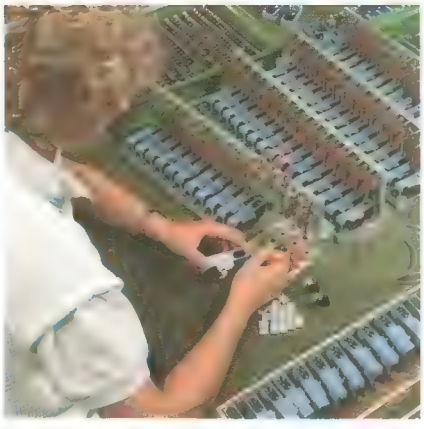
Quality control

Requirements concerning the quality of manufactured goods steadily rise.

Image processing systems and the SICK Laser Scan System allow reliable control of manufactured products. These systems have been developed especially for rapidly moving web-type materials, such as paper, textiles, metals and even for coated films and foils. And we also use light to solve special application problems like inspecting laser disks, optic and magnetic data carriers and the properties of textiles.

Please ask for detailed information.

SICK Service. Worldwide.



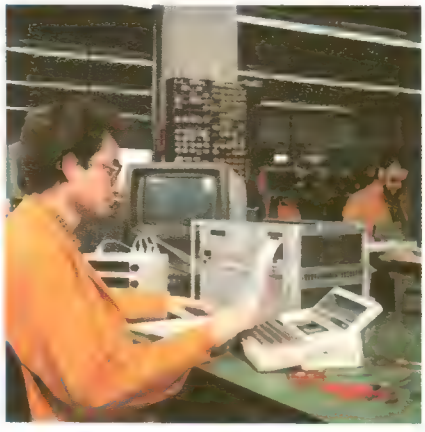
Reliable devices are accompanied by reliable service.

SICK products are fully backed by product support engineers who can discuss customers applications and advise on the selection of the correct devices and their installation.

At SICK, service means comprehensive quality checks to prevent expensive nonproductive downtime. Opto-electronic systems from SICK are applied wherever reliability is a prerequisite for uninterrupted processes. Therefore, every component is put through severe

tests in the SICK quality control department. This ensures that only high-quality products leave the works.

And if problems do ever arise, just call us, SICK service engineers are there to offer prompt and reliable assistance. Not only in Germany, but also at the SICK subsidiaries in France, the Netherlands, Belgium, Switzerland, Great Britain, Denmark, Spain, Australia, Finland, Japan, Singapore, USA.



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